INSTRUCTION MANUAL

FOR

THE MODEL MTR10–191 SERIES

FULLY SOLIDSTATE U.H.F.–FM

MOBILE RADIOPHONE EQUIPMENT

MAY, 1973

ISSUED BY
THE MOBILE RADIO DIVISION
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AMENDMENTS AND ADDITIONAL INFORMATION

The following additional information has been included in this publication:-

Amendment List		Details of Amendment	Section Number
Number	Date		

MTR10-191 - SERIES RADIOPHONE EQUIPMENT

C O N T E N T S

CIRCUITS DIAGRAMS FOR

UHF MOBILE RADIO TELEPHONE EQUIPMENT

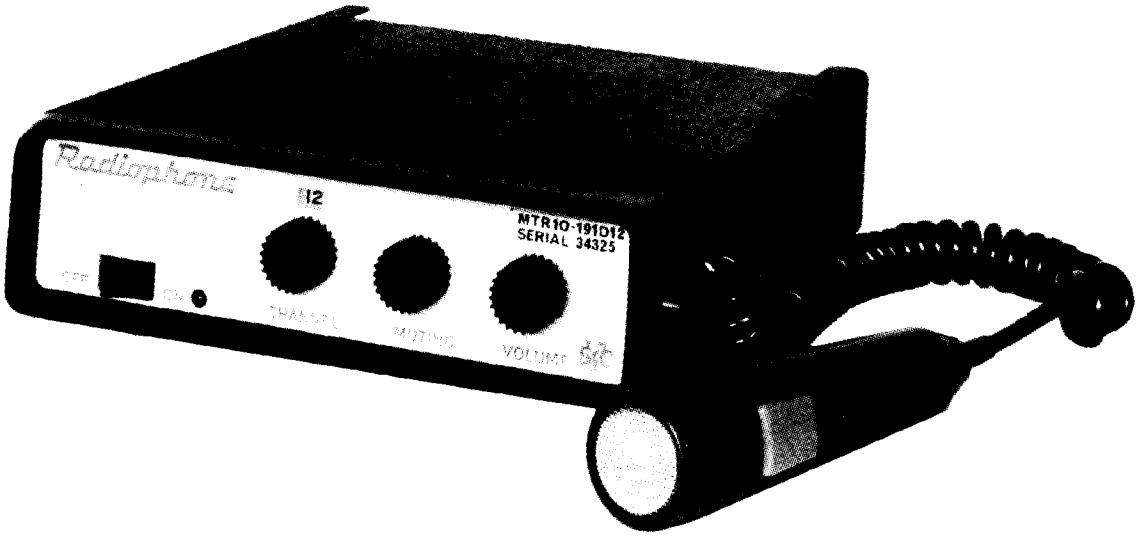
The diagrams are located at the rear of the Manual

SECTION 1 - INTRODUCTION

1.1 GENERAL

The STC MTR10-191C and CT, D and DT Mobile equipments are frequency modulated solid state mobile radio transmitter-receiver units operating in the UHF range of 403-420MHz and 450-470MHz respectively. They are suitable for installation in all vehicles and for operation in a wide range of mobile radiotelephone systems.

Reference should be made to the INSTALLATION INSTRUCTIONS on page 201 before installing an equipment, and to the OPERATING INSTRUCTIONS on the printed card before attempting operation.



TYPICAL UNDERDASH UNIT - REFER TO INSTALLATION SECTION FOR OTHER ARRANGEMENTS

1.2 FACILITIES

There are sixteen basic MTR10-191 series mobile radiotelephone equipments available for either single or multi-channel operation with channel spacing of 25KHz. Equipment for 12.5KHz or 50KHz channel spacing is available when required.

Three models of equipment are available, suitable for underdash, extended control and remote (trunk mounted) control. The equipments provide a transmitting output of at least 10 watts and are defined as under:-

MTR10-191C	403-420MHz, 25KHz	1 Ch: underdash Mtg
MTR10-191C4	403-420MHz, 25KHz	4 Ch: underdash Mtg
MTR10-191C8	403-420MHz, 25KHz	8 Ch: underdash Mtg
MTR10-191C12	403-420MHz, 25KHz	12 Ch: underdash Mtg
MTR10-191CT	403-420MHz, 25KHz	1 Ch: trunk Mtg
MTR10-191CT4	403-420MHz, 25KHz	4 Ch: trunk Mtg
MTR10-191CT8	403-420MHz, 25KHz	8 Ch: trunk Mtg
MTR10-191CT12	403-420MHz, 25KHz	12 Ch: trunk Mtg
MTR10-191D	450-470MHz, 25KHz	1 Ch: underdash Mtg
MTR10-191D4	450-470MHz, 25KHz	4 Ch: underdash Mtg
MTR10-191D8	450-470MHz, 25KHz	8 Ch: underdash Mtg
MTR10-191D12	450-470MHz, 25KHz	12 Ch: underdash Mtg
MTR10-191DT	450-470MHz, 25KHz	1 Ch: trunk Mtg
MTR10-191DT4	450-470MHz, 25KHz	4 Ch: trunk Mtg
MTR10-191DT8	450-470MHz, 25KHz	8 Ch: trunk Mtg
MTR10-191DT12	450-470MHz, 25KHz	12 Ch: trunk Mtg

Controls located on the equipment facia are:-

Volume	-	Controls audio output
On/off	-	Connects battery supply to equipment
Channel	-	Selects required channel (fitted only on multi channel equipment)
Mute	-	Controls the receiver mute operating level (fitted internally unless specified as external mute)

Additional facilities mounted on the equipment facia are:-

Power on Indicator	-	Illuminates when battery supply is connected to the equipment

Transmit Indicator (Optional)	-	Illuminates when transmitter supply is selected
Base Call Press-Button (Optional)	-	Initiates the base call and transmit facility
Car Call Reset Press-Button (Optional)	-	Initiates the reset of the call received indicator
Car Received Indicator (Optional)	-	Illuminates when a car call has been received
Car Call On/Off Selector (Optional)	-	Permits monitoring of the channel before initiating the base call or transmit function

Operation of the transmitter is controlled by a press-to-talk switch located on the hand microphone.

The squelch, or mute circuit, included in the receiver allows the equipment to remain quiescent but still alert to the reception of relevant signals.

1.3 BRIEF DESCRIPTION

The MTR10-191 series mobile equipments are designed to operate from the battery supply of the associated vehicle. The aerial can be fitted conveniently to the roof of the vehicle and connected to the equipment by a concealed coaxial cable. The loudspeaker unit and the microphone clip may be fitted in any convenient position.

Transmitter

The transmitter is a broadband design and provides an output of at least 10 watts over the frequency range 403-420 or 450-470MHz. The F.M. deviation is 5KHz for 25KHz channel separation.

The unit comprises a microphone amplifier with pre-emphasis and de-emphasis circuits, phase modulator, frequency multiplying stages employing transistors and a varactor diode, bandpass filter and power amplifier output stages. A solid state antenna switch enables the use of a common aerial for both transmitter and receiver units. Crystal oscillators enable high stability to be achieved over the output frequency range.

Receiver

The receiver is a double superhetrodyne having I.F.'s of 35.266 to 37.155 and 10.7MHz (403-420MHz band) and I.F.'s of 24.74 to 26.28 and 10.7MHz (450-470MHz band).

The audio output amplifiers provide 2 watts minimum undistorted power to a 3Ω loudspeaker. The unit comprises an R.F. amplifier, a first mixer utilizing a field effect transistor (FET), first I.F. amplifier consisting of an integrated circuit module, second mixer stage employing a field effect transistor (FET) 10.7MHz crystal filter for 12.5, 25 or 50KHz spacing as specified, I.F. amplifier integrated circuit discriminator module, squelch circuit, audio frequency preamplifier and power amplifier stages. Crystal oscillators enable high stability to be achieved within the U.H.F. ranges 403-420MHz and 450-470MHz.

1.4 CONSTRUCTION

The MTR10-191 Mobile equipment is of rugged construction and comprises a front mounting panel and a rear panel assembly. The two are held by two printed circuit boards and secured by screws thus forming a main framework. The P.C.B. side boards also provide for distribution of the d.c. supplies.

Fitted along the side boards are polypropylene retaining clips between which are secured the transmitter and receiver printed circuit boards. The boards are secured at one end by screws and at the other end are held by slots.

The equipment assembly can be easily arranged into transmitter and receiver sub-units to reveal both sides of the circuit boards. This allows most fault finding, alignment and repair, to be effected without any further dismantling.

1.5 COMPOSITION

The MTR10-191 Mobile equipment comprises the following Units and Boards.

Transmitter Unit comprising:-

- Microphone Amplifier Board
- Transmitter Multiplier Board
- Transmitter Filter
- Transmitter Output Board
- Hand Microphone

Receiver Unit comprising:-

- Receiver R.F. Board
- Receiver I.F. Board
- Receiver A.F. & Squelch Board
- Transmitter/Receiver Oscillator Board (single channel equipments only)

Transmitter Oscillator Board (multi channel equipments only)
Receiver Oscillator Board (multi channel equipments only)
Power Supply Board

Car Installation Kit (including loudspeaker, aerial and 2 fuses). See Installation Instructions - Section 2.

1.6 TYPICAL PERFORMANCE

Type of Transmission	Phase modulated radio telephony
Frequency Range	U.H.F. 403-420MHz or 450-470MHz
Audio Input Impedance	Nominally 300Ω unbalanced
R.F. Impedance	50Ω unbalanced
Maximum Frequency Deviation	5 or 15KHz at 1000Hz as specified
Operating Ambient Temperature Range	-10°C to +60°C without equipment damage

1.6.1 Transmitter

Output Power	10 watts minimum at 13.8 volts and 20°C ambient temperature at commencement of specified duty cycle
Input for Maximum Deviation	1mV pd at 1KHz
Spurious Emission	The level of any spurious emission will be at least 66db below the full output power, when measured into a 50Ω load at the output terminal
Audio Frequency Response	Within +1 to -3db of a true 6db/octave pre-emphasis characteristic from 300Hz to 3KHz referred to the 1KHz level (E.I.A. specification)
Frequency Stability	± 0.0005% over the temperature range -10°C to +60°C with reference to frequency at 24°C
Noise Level	-35db relative to 5KHz deviation at 1000Hz

1.6.2 Receiver

Sensitivity	0.4uV pd to open squelch and 12db signal to noise and distortion (SINAD) at 0.5uV pd. 0.7uV pd for 20db quieting.
Limiting	Audio output level will not vary by more than 3db for r.f. signal input level between 1uV and 50mV pd.
Spurious Response	None greater than -75db referred to 0.5uV pd input.
I.F. Bandwidth	
25KHz Spacing	± 7.5KHz at -6db ± 25KHz at -80db
50KHz Spacing	± 15KHz at -6db ± 50KHz at -80db
Signal-To-Noise Ratio	28db minimum for 1.0uV pd input signal 5KHz deviation 1000Hz modulation frequency.
Selectivity	70db when tested with two input signals.
Audio Frequency Response	Within +1db and -8db from 300Hz to 1000Hz and within +1db and -4db from 1000Hz to 3000Hz with reference to 3000Hz with reference to 6db per octave de-emphasis when referred to the 1000Hz level.
Audio Output Level	2 watts for 5% distortion, 2.5 watts for 8% distortion (5.0uV pd input 5KHz deviation at 1000Hz modulation frequency) 3Ω impedance.

1.6.3 Power Supply Requirements

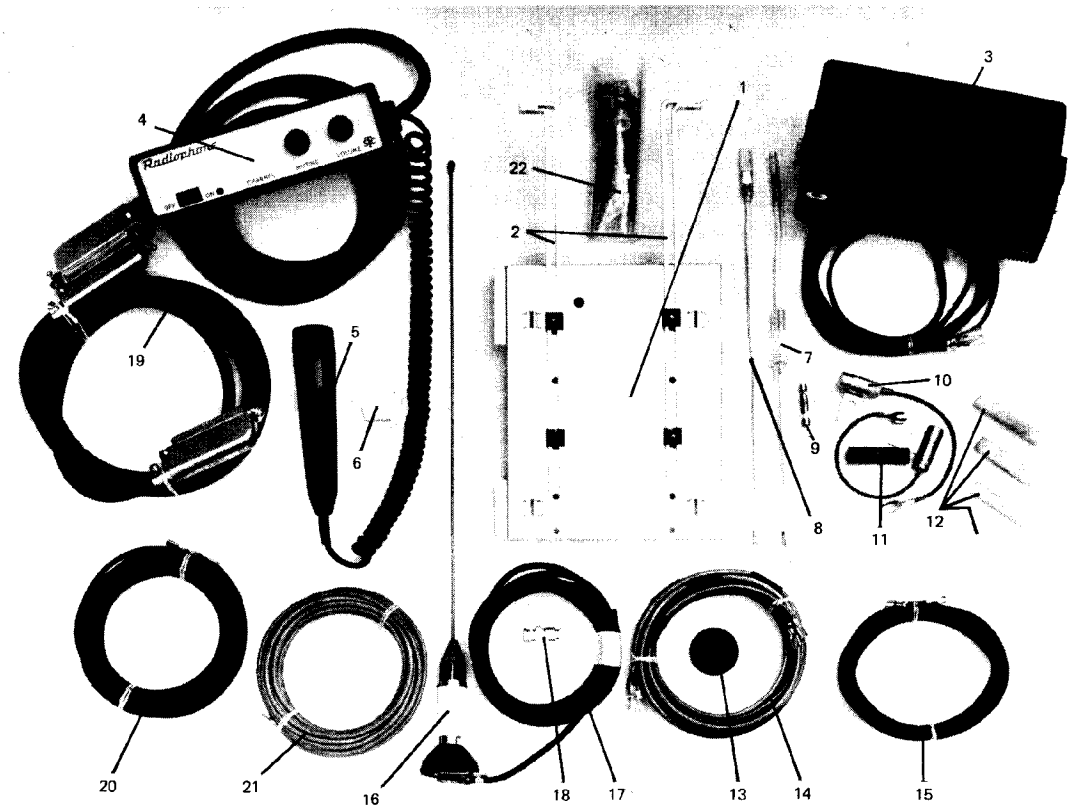
Nominal Supply Voltage	12V d.c.
Test Voltage	13.8V d.c.
Power Consumption	3.5A on transmit 200mA on receive (with options)

SECTION 2 - INSTALLATION INSTRUCTIONS

2.1 GENERAL INFORMATION

The equipment supplied for the installation of the MTR10-191 series has been designed to provide efficient, reliable service and a long life under rugged conditions. To obtain the maximum efficiency it is essential that the initial installation should be carefully planned and executed.

INSTALLATION KIT ACCESSORIES



The illustration combines the accessories used for the installation of the MTR10-191 Mobile Units, which may be positioned a) underdash, b) extended into a convenient position e.g. under a seat, c) boot mounted.

2.2 SCHEDULE OF MATERIALS

The component parts of the complete mobile kit assemblies are detailed below.

The equipment for each type of installation i.e. Under Dash, Extended Control and Remote Control are packed in a special container, the container comprises the items as follows:-

a) Underdash

Mobile Unit complete with microphone and bracket, Loudspeaker complete with bracket and cable. Whip Aerial assembly complete with plug.

Mounting tray complete with two brackets, supply cable assembly, suppressor components and installation hardware contained in a plastic bag.

b) Extended Control

Mobile Units (extended model) Loudspeaker complete with bracket and cable. Whip Aerial assembly with plug.

Mounting tray, supply cable assembly, suppressor components and installation hardware contained in plastic bag.

Control Head complete with microphone, bracket and 7' control cable.

c) Remote Control

Mobile Unit (extended model) Loudspeaker complete with bracket and cable. Whip aerial assembly mounting tray, compressor components and installation hardware in plastic bag.

Control head complete with microphone bracket and 7' control cable. Extension 10' control cable and 10' extension speaker cable.

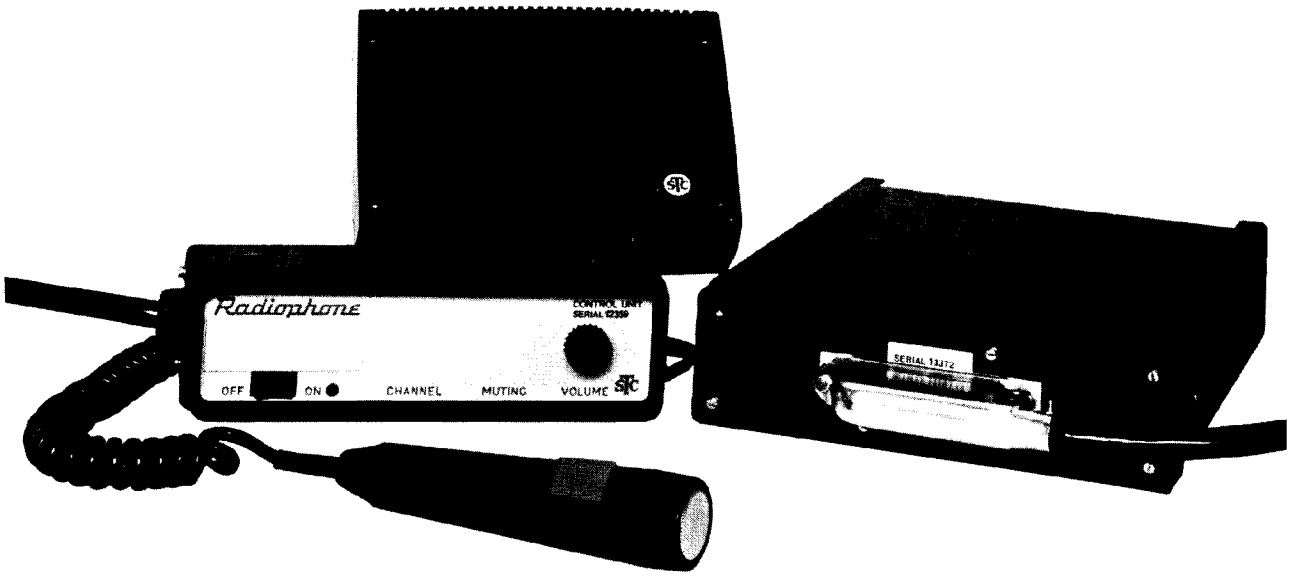
Items and quantities comprising the installation kit assemblies available in the MTR10-191 mobile radiophone series are set out in the following table and should be read in conjunction with Fig. 36.

The full installation material details are listed at the end of this section.

ii) The mounting brackets provided with "UNDERDASH" mobile installation kit will in most cases, not be required for the extended or remote control unit installation, and these are therefore not included with the extended or remote installation kits.

iii) Suitable mounting brackets are supplied with each microphone and loudspeaker depending on the type supplied.

iv) Single or Multi Channel Control Heads are supplied with a 7 ft. extended cable terminated with a multi-plug and socket type connector. A matching 10' extension cable is provided with a trunk mounted installation.



Typical Single Channel Control Head Installation

2.3 INSTALLATION PROCEDURES

Check that all items supplied are free from damage or defects. In most cases it is left to the discretion of the user regarding the location in the vehicle of the items comprising the MTR10-191 mobile equipment.

Having chosen the location for the transmitter/receiver unit, in general beneath the dashboard, ensure that there is adequate space to accommodate the mounting tray and that the supporting members of the firewall and dashboard will carry the weight of the unit, 6 lbs. When fitting the mobile mounting assembly, allowance should be made for rear connections to the supply and aerial leads to the mobile unit. Whilst examining this area locate the nearest vacant hole in the firewall which will accept the bush and battery cables provided, it may be necessary to cut a suitable aperture for this purpose. The loudspeaker should be mounted in a convenient position to provide the best possible sound reproduction.

Examine the headlining of the vehicle and feel for any obstructions which may interfere with the mounting of the aerial in the roof centre line.

Assemble the tools necessary to carry out the installation;

(a) A power drill, with assorted drills.

(b) A 3/4" hole-cutter for the aerial, and a 1" for the firewall bush.

(c) Screwdrivers and spanners as required.

(d) A multimeter.

2.3.1 Install Aerial

The type RMW/311-L and RMW/311-H are high gain mobile whip antennas for use in the 402-470 MHz UHF band and are designed for vehicle centre roof top mounting.

These aerials consist of a 5/8 wavelength stainless steel radiator and loading coil. The installation is simple, the coil requires no tuning and the whip may be cut to the desired frequency. (see illustration on page

(a) Cut a 3/4" hole through the metal roof and remove antidrum compound, taking care that the drill does not damage the headlining beneath.

(b) From the inside remove the trim from the windshield pillar and surround. Ease the headlining sufficiently free to pass the coaxial cable through the

(i) Place the coaxial cable in the corner post, through and under the dashboard to the transmitter/receiver unit. Refasten the lining and trim. Allow a few inches of slack on the cable and cut to length.

(j) Strip the cable and connect to the coaxial cable plug provided.

(k) Ensure that the sheath of the coaxial cable is connected to the car frame (through the aerial sub-assembly plate). Check with the ohmmeter and if the resistance between the sheath and frame exceeds 0.1 ohms the sub-assembly plate must be reset to ensure a good contact through the metal roof.

(l) Check for a high impedance reading between the centre conductor of the cable and the sheath, and continuity between the whip and the centre conductor.

2.3.2 Install Mounting Tray

(a) Determine the exact position of the tray to be mounted on the dashboard, with the front of the transmitter/receiver unit in line with the dashboard. Ensure that there are no obstructions and that there is space at the sides to permit access to the unit mounting screws and the socket connections on the right hand side of the unit.

(b) Drill 3/16" clearance holes in the dashboard underside frame and bolt the tray in position.

(c) Line up the sidebars to bolt to the firewall and the mounting tray. Drill the firewall and secure as necessary.

2.3.3 Install Transmitter/Receiver

(a) Fit the bush in the firewall and insert the battery leads through to the engine compartment. Sufficient length should be allowed to permit connection of the plugs at the right hand side of the transmitter/receiver unit.

(b) Fasten the leads to the vehicle wiring harness.

(c) The transmitter/receiver unit is mounted in the tray provided.

(b) Switch on and establish a call to the base station on the correct channel frequency. In the event of difficulty in transmitting or receiving the set should be checked out in accordance with the procedure laid down in Section 4.

INSTALLATION MATERIAL:-

To meet the requirements of the three modes of operation viz., Local, Extended and Remote Control, installation material is supplied as follows:-

(a) Combined Local and Extended Control Installation

(b) Remote Control Installation

(a) Local and Extended Control Installation

Part No.	Description	Qty.	Other Information
342543	Lead Assy. 12" white	1	
342548	Lead Assy. fused (5A) 12" white	1	
342542	Lead Assy. Battery 90"	1	
342785	Plug Self-sealing Blk .750 dia.	1	
222147	Suppressor 5000 ohm	1	
289727	Capacitor 500 NF 200V	2	
	Hardware Items:- Local Control		
254588	Screw 1½ x ¼ NF Hex Hd	2	Mtg. Tray b'kts rear fixing
254589	Nut full ¼ NF Hex	2	" " " " "
218626	Washer flat ¼	4	" " " " "
245925	Washer Shkp ¼	2	" " " " "
254586	Screw #8 x 3/8 Pan Hd. Posi-Drive	2	" " front fixing
219221	Washer Shkp	2	" " " "
254592	Screw #8 x 5/8 Pan Hd. Posi-Drive	4	" " b'kts to tray fixing
342540	Nut special	4	" " " " " "
254585	Screw #8 x 1" Pan Hd. Posi-Drive	3	L/Spkr (6 x 2) b'kt fixing
219221	Washer Shkp	3	" " " "
254587	Screw #4 x ¼ Csk. Hd. Posi-Drive	2	Microphone Clip fixing

Part No.	Description	Qty.	Other Information
219105	Screw #4 BA x ¾ Ch. Hd. Slotted	2	Con/Head f'xg(top & btm face)
219210	Washer flat 4BA	4	" " " " " "
219226	Washer Shkb 4BA	2	" " " " " "
246418	Nut full 4 BA	2	" " " " " "
254585	Screw #8 x 1" Pan Hd. Posi-Drive	3	L/Spkr (6 x 2) b'kt fixing
254587	Screw #4 x ¼ Csk Hd. Posi-Drive	2	Microphone Clip fixing
254591	Screw 1" x ¼ NF Hex Hd.	1	Earth bolt. Assy.
254590	Nut ¼ NF Flanged	1	" " "
218626	Washer flat ¼	2	" " "
245925	Washer Shko ¼	1	" " "
254589	Nut Full Hex ¼ NF	1	" " "
342780	Lug	1	" " "

Note: The Control Head extension cable is not included in the Installation Kit. Use Cord Connector ended 351682 for single channel and 351684 for all multi channel use.

When alternate equipment is supplied e.g. 6 x 4 Loudspeaker, H/Duty Microphone additional hardware items required are supplied with the item.

351678 Box Speaker (6 x 4)

254585	Screw #8 x 1" Pan Hd. Posi-Drive	2
219208	Washer flat	2
219221	Washer shkd.	2
	alternate single hole mounting	
254593	Bolt Cup Hd. Sq. Neck 2" x ¼ white	1
218626	Washer flat ¼	3
245925	Washer Shkd	1
218587	Nut full Hex. Hd.	1

351677 Microphone H/Duty

063536	Bracket Mtg.	1
285854	Screw #6 x ¼ Rd. Hd. Posi-Drive	2

Part No.	Description	Qty.	Other Information
	Extended Control		
254585	Screw #8 x 1" Pan Hd. Posi-Drive	4	Mtg. tray to firewall fixing (alternative to b'kt mtg.)
219221	Washer Shkp	4	" " " " "
254586	Screw #8 x 3/8" Pan Hd. Posi-Drive	4	Con/Head fixing (rear face)
219105	Screw 4BA x ¾" Ch. hd. Slotted	2	" " " (top & btm face)
219210	Washer flat 4BA	4	" " " " " "
219226	Washer Shkp 4BA	2	" " " " " "
246418	Nut full. 4BA	2	" " " " " "
(b)	Remote Control Installation		
342543	Lead Assy. 12" white	1	
342548	Lead Assy. fused (5A) white	1	
342544	Lead Assy. (19/018) 20 ft. bk.	1	
342545	Lead Assy. (19/018) 20 ft. Rd.	1	
342525	Lead Assy. Fig. 8 Bk. 10 ft.	1	
342784	Plug Self Sealing 1.250 dia.	1	
342785	Plug Self Sealing .750 dia.	1	
222147	Suppressor 5.000 ohm	1	
289727	Capacitor 500NF 200V	2	
342783	Adaptor Q.C. ¼ male	2	
342781	Adaptor Q.C. 3/16 male	2	
	Hardware Items		
254585	Screw #8 x 1" Pan Hd. Posi-Drive	4	Mounting Tray fixing
219221	Washer Shkp	4	" " "
254586	Screw #8 x 3/8 Pan Hd. Posi-Drive	4	Con/Head fixing (rear face)

2.3.4 Install Microphone

(a) Select a convenient location on the dashboard front panel, providing easy access for the operator.

(b) Secure the holder to any convenient position allowing good access for the operator.

(c) The microphone cord may be dressed for left or right hand entry into the side of the unit to ensure that the cord will cause no obstruction to the driver.

2.3.5 Install Interference Suppressors

(a) The suppressor should be fitted in series with the distributor HT lead, as close to the distributor head as possible. Most modern vehicles are fitted with carbon ignition leads in which case the suppressor is not required.

(b) The capacitors should be connected across the output terminal of the generator and frame, usually the thicker lead, and the battery side of the ignition coil. The flexible lead of each capacitor is connected to the appropriate terminal with their cases bolted to the most convenient earthing point on the vehicle.

WARNING: DO NOT CONNECT THE CAPACITOR TO THE FIELD TERMINAL

2.4 D.C. SUPPLY AND LOUDSPEAKER CONNECTIONS

Connection to the battery supply is made via the low tension supply leads. The positive supply is connected to the red/blue lead and the negative to the black/green lead. The black and white leads are for connection to the loudspeaker unit.

Both the d.c. and loudspeaker connections are made via special type connectors which when disconnected ensure that supplies are fully insulated.

2.5 COMMISSIONING

(a) After completion of the installation and before switching on carry out a detailed check that the foregoing instructions have been followed and that all connections, plugs and fastenings are secure.

hole in the roof and down via the windshield pillar to the underside of the dashboard.

(c) Unscrew the whip and remove the aerial base and gasket. The coaxial cable is connected to the aerial sub-assembly.

(d) Feed the cable through the hole in the roof; from inside draw all the slack through until the sub-assembly is adjacent to the hole.

(e) Tilt the cable clamp end of the sub-assembly plate towards the front edge of the hole and slide the plate through, holding the screwed shaft with the special tool provided. Straighten the plate and centre in the hole.

(f) Reassemble the aerial in the following order:-

(i) Rubber gasket

(ii) Aerial base

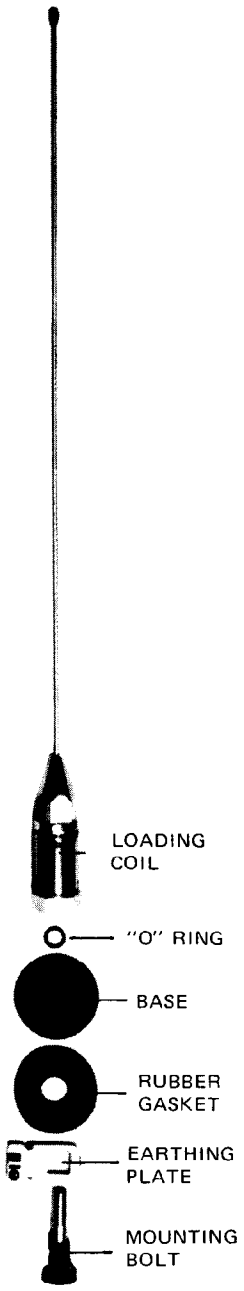
(iii) 'O' ring

(iv) Carefully remove special tool and screw the whip assembly in position.

(g) Ensure that the shoulder on the aerial base clears the hole and enters the cup in the base plate. Tighten the nut of the whip assembly and check that the protruding spikes of the base plate penetrate the anti-drum compound and make good contact with the metal roof.

DO NOT OVERTIGHTEN THE NUT.

(h) The whip can be cut to the desired frequency. The coil is standard over the frequency range and does not require tuning. Screw on the whip.



UHF AERIAL
TYPE RMW 311-H/L

TABLE OF CONTENTS

FIG.36 ITEM NOS.	DESCRIPTION	TYPE OF CONTROL U/DASH	EXT.	REMOTE	PART NOS.
	Mounting Tray Assy.	1	1	1	342272
	Brackets (Mtg. Tray)	2	-	-	342541
4-5	7'-6" Twin Battery Power Lead Assy.	1	1	-	342542
6	12" Single Power Lead (white) Assy.	1	1	1	342543
7	12" Single Power Lead (white) fused assy.	1	1	1	342548
3	8' Twin Lead (black) part of Loudspeaker Assy.	1	1	1	342163
7	Fuse Auto. 5 Amp	1	1	1	259237
1	Cable Microphone Assy.	1	1	1	342209
2	10' Cable Co-axial c/w BNC Connector part of Aerial Assy.	1	1	1	c/w Aerial
8	Cord Connector ended 84"				
	Cord Single Channel		1	1	342394
	Cord Multi Channel		1	1	342380
	(OR)				
9	Cord Connector ended 10'				
	Cord Single Channel			1	351682
	Cord Multi Channel			1	351684
	(OR)				
10	10' Lead Assy (black)			1	342525
11	20' Lead Assy (black)			1	342544
12	20' Lead Assy (red)			1	342545
	Kit Installation Hardware	1	1		351680
	Kit Installation Hardware			1	351681

NOTES

i) Mounting trays are common to all Models. Suitable holes are provided to allow the tray to be installed in the desired position.

KEY TO ILLUSTRATION

1. Mounting tray
2. Brackets (Mtg.)
3. Loudspeaker and 8 ft. lead assy.
4. Control head and 7 ft. lead assy.
5. Pencil microphone
6. Microphone bracket
7. 12" single power lead (white) fused assy.
8. 12" single power lead (white) assy.
9. Fuse auto 5 amp.
10. Suppression Capacitor
11. Suppression Resistor 5KΩ
12. Quick connect/adaptor 3/16" & ¼"
13. Grommet
14. 7'-6" Twin battery power lead assy.
15. Lead assy. 10 ft. (black) speaker extension
16. UHF Aerial
17. Co-axial Cable
18. Co-axial Connector
19. Control head extension cable 10 ft. (Boot Mtg.)
20. Extension power lead (black) (Boot Mtg.)
21. Power lead extension 20 ft. (red) (Boot Mtg.)
22. Hardware

Care must be taken in the choice of location of the component parts; mountings should be rigid and secure and, where so specified, efficient bonding to the vehicle frame ensured.

The equipment must in no way impede the freedom of movement of the driver or his access to instruments and controls.

It should be conveniently accessible to the driver and, in order to permit maintenance and tuning adjustments to be carried out, the transmitter/receiver front must be kept clear to allow removal from the mounting tray.

The instructions are applicable to an installation for a standard vehicle, and if carefully followed no problems should be encountered. However, for special applications or where any doubt exists, reference should be made to the supplier or his accredited service agent.

SECTION 3 - GENERAL SERVICING INFORMATION

3.1 GENERAL

Great care has been taken in the design of the MTR10-191 Mobile equipment to achieve a long working life combined with a very high standard of reliability. The quality of the components used is the highest available and the circuits have been skilfully designed and conservatively rated. The equipment is housed in a dust-proof case and no routine maintenance is necessary.

3.2 PRECAUTIONARY MEASURES

CAUTION:-

The equipment has been designed to operate safely under a wide range of aerial loading conditions. However, it is strongly recommended that the transmitter should not be operated in the absence of a suitable load. Failure to observe this warning may result in damage to the transmitter output power module.

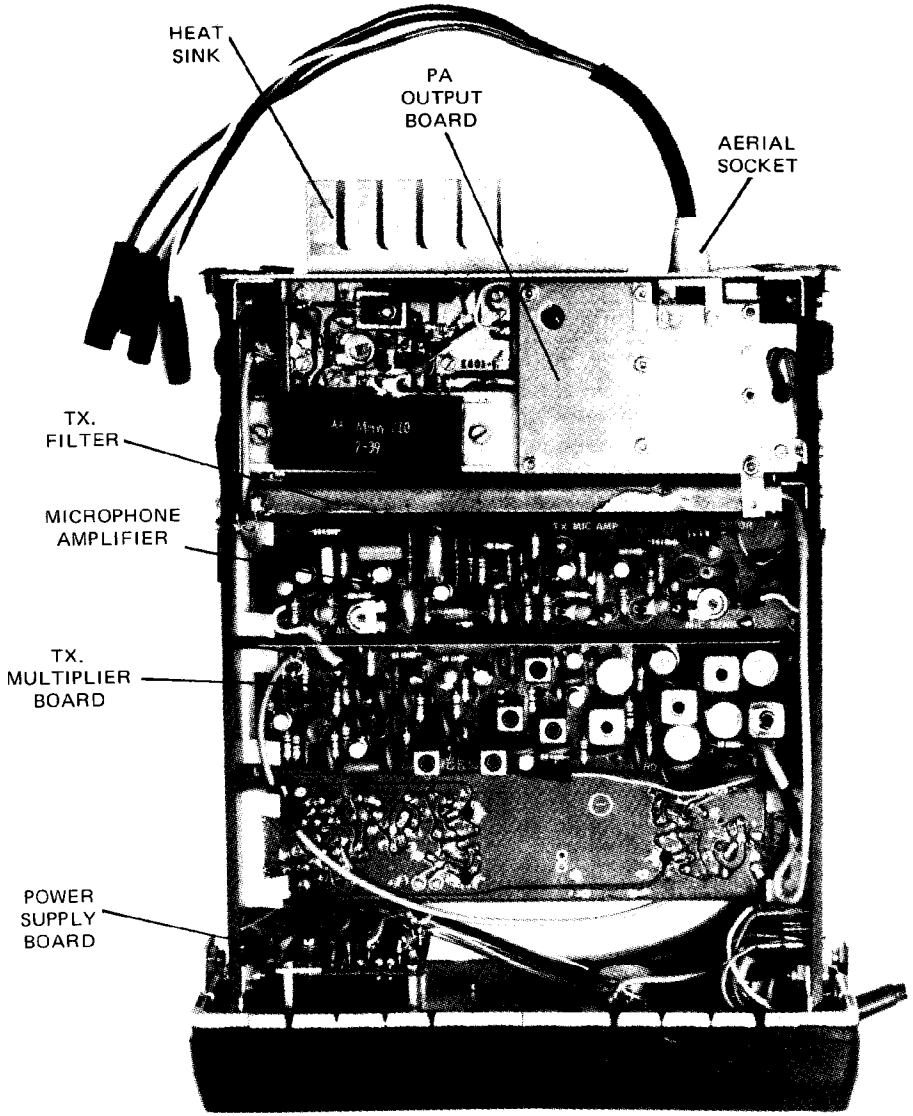
Particular attention should be paid if it becomes necessary to replace the field effect transistor (FET), TR2 on the Receiver R.F. Board. A low voltage soldering iron should be used, preferably from a d.c. supply, and several turns of thin tinned copper wire should be wound round the four base connections of the device during the soldering process in order to dissipate heat and prevent excessive voltages from being applied to the electrodes. When the transistor has been satisfactorily soldered into position, the wire loops must be cut free.

Soldering operations should be kept to a minimum. Printed circuit tracks should be clean before applying solder or iron and the amount of solder and heat applied should be kept to a minimum. Heat shunts should be used to conduct away excessive heat. Where possible a d.c. low voltage soldering iron should be used with an earthed bit. The equipment supply should be disconnected whilst carrying out any soldering operation. Test leads should not be soldered to the printed circuit track.

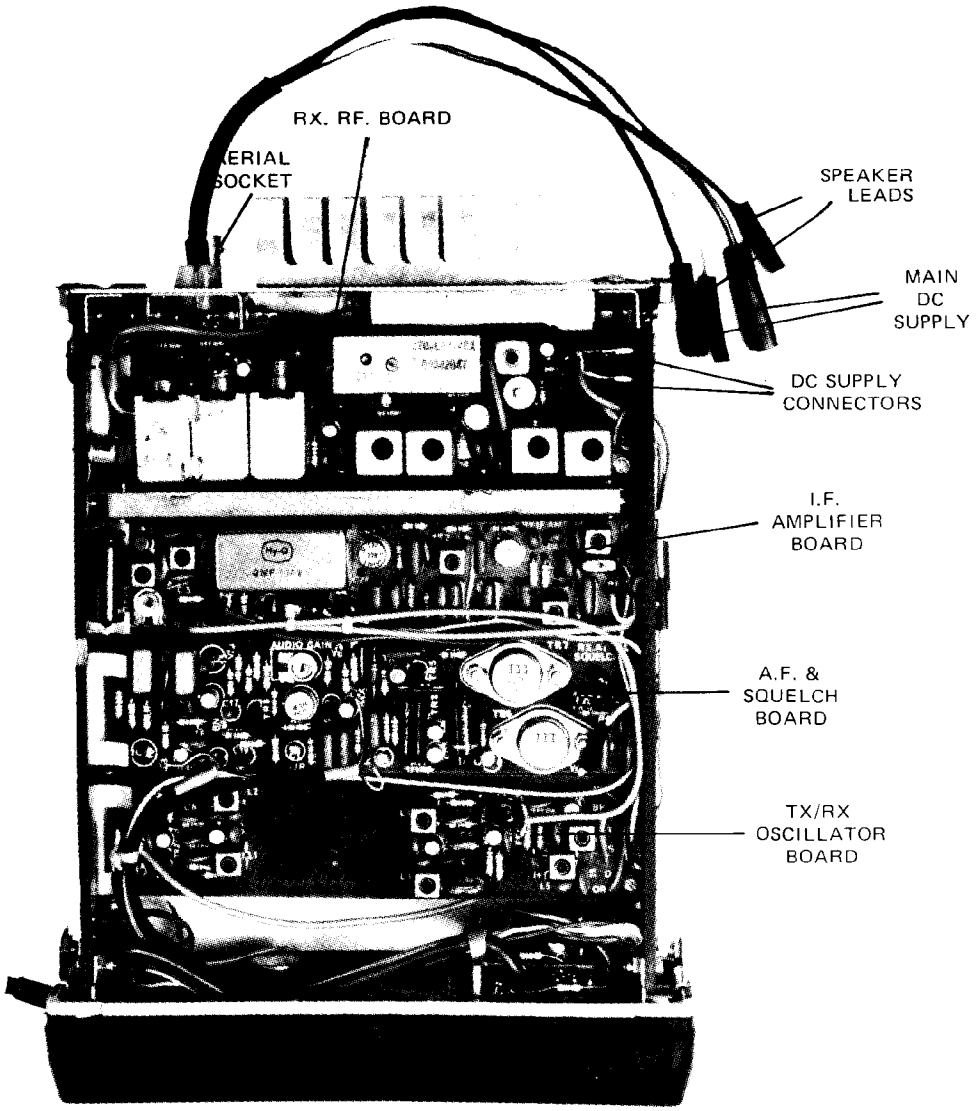
Buzzers should not be used for continuity checks as these may damage the semiconductor devices.

3.3 TEST EQUIPMENT

The following list includes recommended types of test instruments for overall equipment alignment and fault location. Where the specified test equipment is not available equivalent types may be used.



TRANSMITTER



RECEIVER

STC MOBILE MTR.10.191. C or D. UHF EQUIPMENT.

IF NO AUDIO OUTPUT

ix) Check the oscillator tripler circuit by connecting a millivoltmeter across the coaxial cable points D and Ds on the Receiver R.F. Board. If no output check tripler circuit components.

IF SIGNAL PRESENT

x) Transfer the millivoltmeter to points F and Fs on the Receiver R.F. Board. This should register a high output. Reduce the signal generator output level and check that the millivoltmeter reading falls. This indicates that the Receiver R.F. Board is functioning. If no signal is recorded or if it does not reduce with input reductions then the board is faulty. If board is functioning correctly the fault is within the Receiver I.F. Board.

After a fault has been isolated to a particular board, reference should be made to the Fault Location Data contained in the Board Descriptions and Maintenance section for more detailed information.

B. Transmitter

If the fault is within the transmitter, the following procedure should be adopted.

i) Check the 13.8V and 9V d.c. supplies. If not present the fault is within the power supply circuit.

IF PRESENT

ii) Check that the red lamp lights when the PTT switch is depressed. If the lamp fails to light, the lamp is defective or the fault is within the PTT switch or power supply circuit.

IF LAMP LIGHTS

iii) Check the modulation level of carrier using Modulation Monitor, in the absence of modulation then the fault is within the Microphone Amplifier Board, the microphone, or possibly the phase modulator is defective.

IF CARRIER NOT PRESENT

iv) Connect a power meter to the aerial output socket. If power is registered (10 watts) it is advisable to monitor the output using a frequency counter as it is possible that the equipment is not working on the correct channel frequency. If frequency is correct, the fault is within the aerial or connector. Switch equipment off immediately.

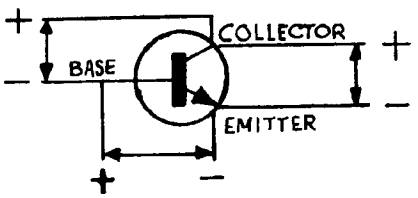
Measurement of Transistor Junctions

WARNING:-

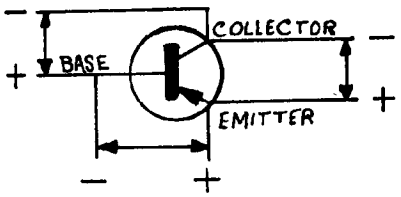
The following information is not applicable to field-effect transistors and should these be suspect replacement is advised after reference to the caution on page 301.

If a transistor is suspected of defective operation an indication of it's performance can be assessed by measuring the forward and reverse resistances of the junctions. Firstly, ensure that the transistor is not shunted by some circuit resistance, unless the device is completely unsoldered. An Avometer Model 8 or similar multimeter should be used for the measurements, ensuring that only the low and middle resistance ranges are used.

It should be remembered that the actual polarity of the '+' terminal on an Avometer when set to OHMS is negative and the '-' terminal is positive. The diagrams below indicate the polarities required to measure the forward resistance of both n-p-n and p-n-p devices. This should be in the order of approximately 1000Ω. To measure the reverse resistances the Avometer leads should be reversed. The reverse resistances should be in the order of at least 100K Ω.



NPN TRANSISTOR



PNP TRANSISTOR

3.7 OVERALL ALIGNMENT

The following procedure is based on the assumption that alignment will only be necessary when it is required to change the channel frequency. However, the procedure should also prove useful as a quick check of the frequency conscious circuits.

Remove the four retaining screws and withdraw the unit from the mounting case. Invert the unit to expose the receiver circuit boards, see illustration on page 308.

iii) Transfer the valve voltmeter to the oscillator input on the Receiver R.F. Board. Adjust coil L5 and transformer T3 on a single channel equipment or coil L1 and transformer T1 on a 3 and 5 channel equipment, L502 and T501 for 4 channel equipment and L2 and T1, 8 and 12 channel equipment, for a maximum indication of 0.5 to 1.0V.

iv) On the Receiver R.F. Board adjust capacitor C21 for maximum voltage across resistor R13 and capacitor C23 for a maximum R.F. voltage indication at junction R5/R6 and common neg.

v) Set the F.M. signal generator to the first I.F. and adjust the output level to 200mV. Connect the signal generator to the first I.F. and adjust the output level to 200mV. Connect the signal generator to the R.F. input on the Receiver R.F. Board and connect the valve voltmeter to pins F and Fs.

vi) Adjust coil L2, L3, L4 and L5 for maximum indication on the valve voltmeter.

vii) Readjust the signal generator to the channel input frequency and adjust transformer T1, T2 and T3 for maximum output on the valve voltmeter.

viii) Replace the loudspeaker by a power meter and adjust transformer T1, T2 and T3 and capacitor C21 and C23 for minimum noise output reducing the signal generator level as necessary.

ix) The overall receiver sensitivity for 12 db signal-to-noise and distortion should be better than 1uV EMF.

x) Turn the equipment to its normal physical working position and readjust oscillator frequency shift coil, if necessary, for the correct working frequency.

C. Transmitter Unit

i) Connect the termaline power meter to the aerial output socket and ensure that the PTT switch is operated.

ii) Connect VTVM or multiset to case of TR7 and tune coils L7, L8, L10, L11 & L12 on multiplier board for maximum output.

iii) Connect VTVM or multiset to case of TR6 adjust capacitor C33 for maximum output.

iv) Adjust capacitors C22, C24 & C23 for maximum output on the power meter.

v) Count Tx carrier frequency. Tune coil L2 on oscillator board, if necessary.

vi) Connect output from the audio generator to terminals RD & BL on the righthand sidepanel. Tune the modulation monitor/deviation meter to operating frequency.

vii) Set deviation adjustment pot.R27 on microphone amplifier board so that IOMVOLTS at 1 khz input gives 5Khz deviation.

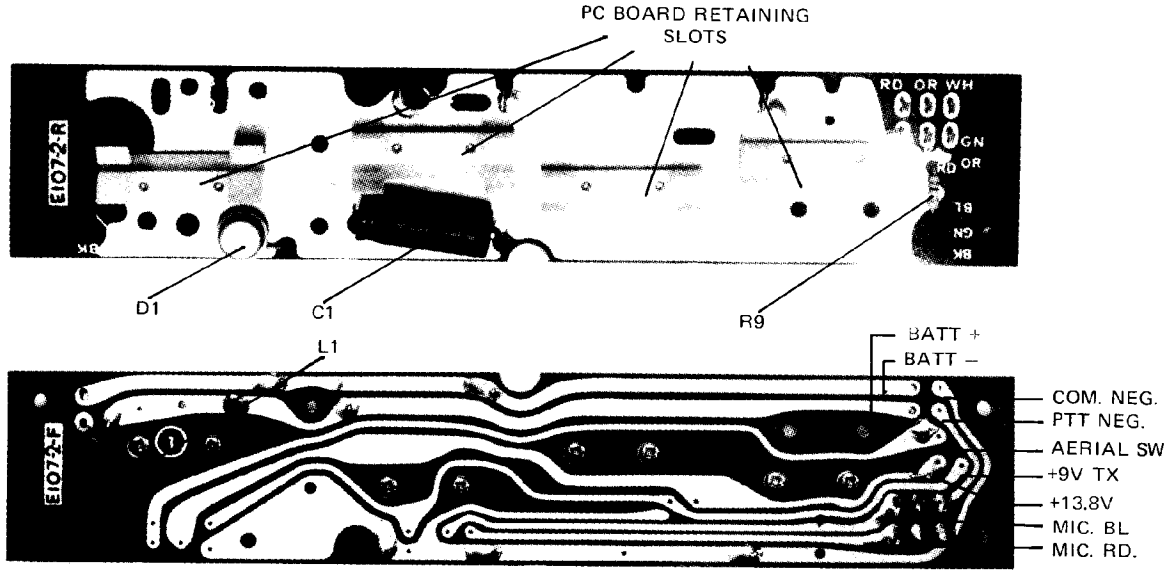
viii) Set microphone sensitivity pot for 1 MVOLT at 1 Khz input gives 3.5 Khz deviation.

3.8 CASE MOUNTED COMPONENTS

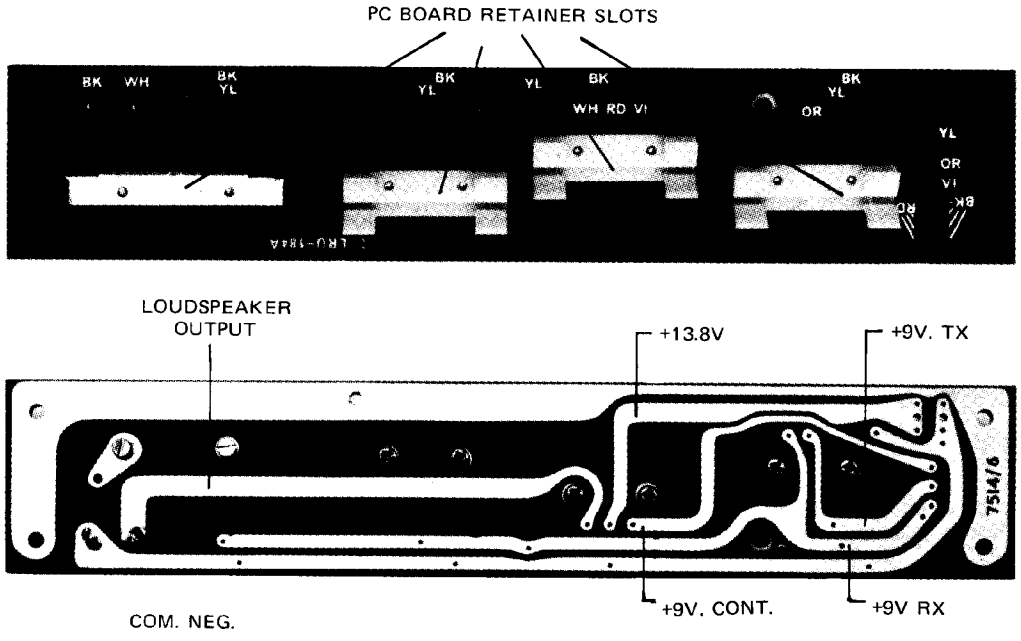
Tabulated below are the circuit references (where applicable), descriptions and manufacturing codes of the case mounted components. On the single channel version the channel selector switch is replaced by a blanking plate.

Circuit Reference	Description	STC Order No.
	Switch (ON/OFF)	37C-SW41-220-0BA (342810)
R1	Volume control 4.7KΩ 20% Morganite Type U log.	37C-RS22-347-EXA (342844)
R2	Squelch control 4.7KΩ 20% Morganite Type U lin.	37C-RS22-347-GXA (342845)
	Channel Selector Switch	(342843) S.P. 12 way
	Power Supply	14-LRU-471 (342098)

3.9 SIDE BOARDS

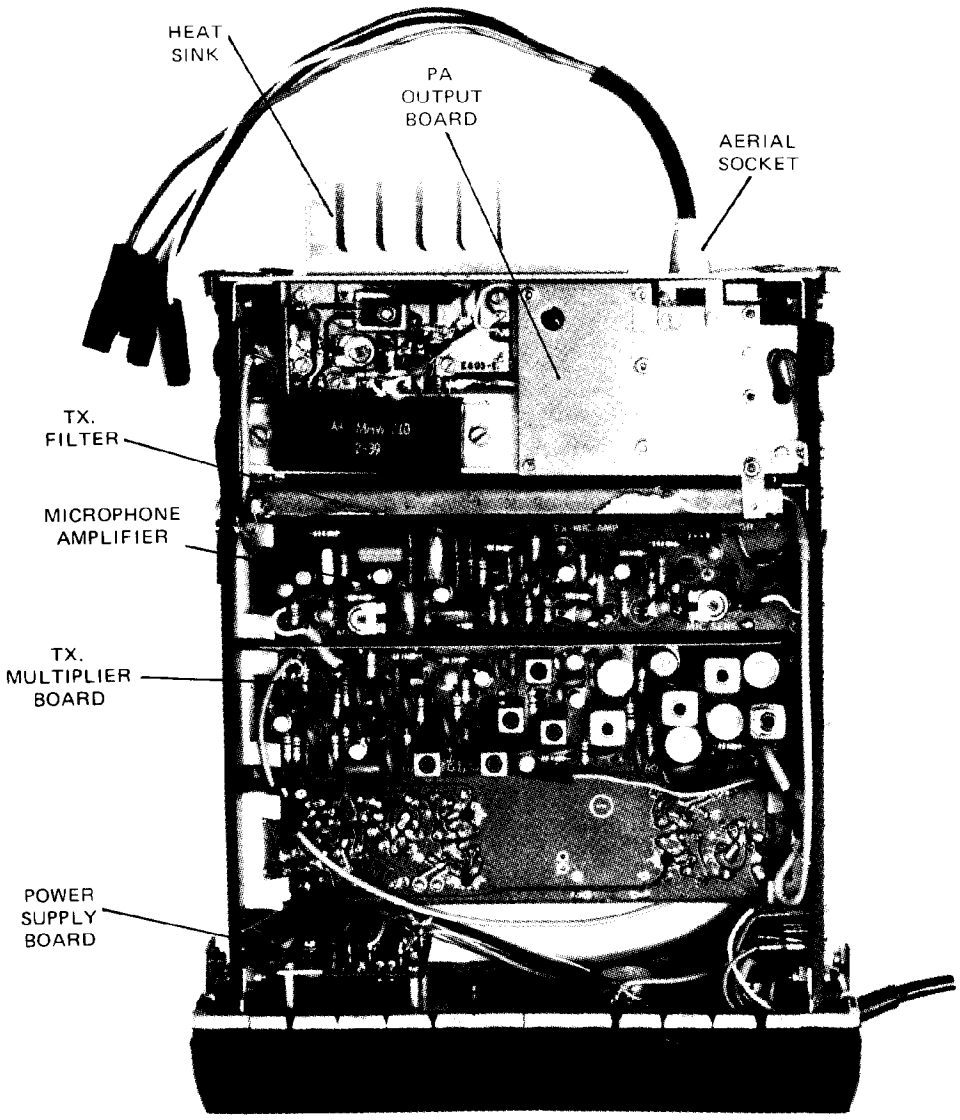


TRANSMITTER SIDE BOARD (FRONT & REAR VIEW)



RECEIVER SIDE BOARD (FRONT & REAR VIEW)

D.C. distribution within the MTR10-191 Mobile equipment is made via the Transmitter and Receiver side boards. The boards are illustrated above with typical d.c. potentials, measured with respect to earth (using a multimeter AVO Model 8).



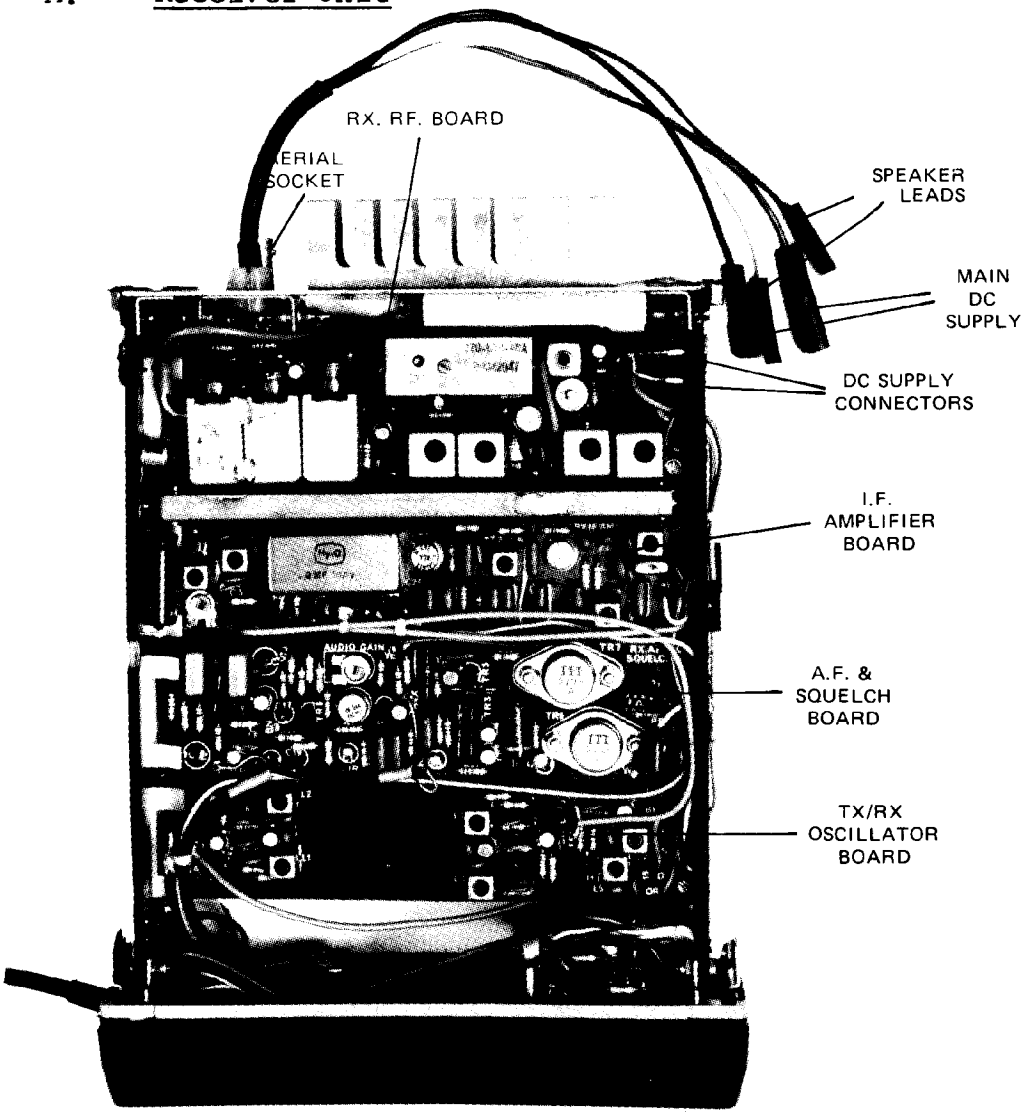
B. Transmitter Oscillator Board

i) Connect a valve voltmeter to pins A & As (or O/P & S) on the Transmitter Oscillator Board. Adjust coil L1 (or C203) for a maximum indication of approximately 0.25V and turn the core one turn in a counterclockwise direction when applicable.

ii) Connect a frequency counter to pins A & As on the Transmitter Oscillator Board. Adjust the frequency shift coil for the correct operating frequency.

NOTE: The references given above are for a single channel equipment. Corresponding components should be adjusted on a multichannel equipment. See board description in section 4 of the manual.

A. Receiver Unit



i) Connect a valve voltmeter to pins E & Es on the Receiver Oscillator Board. Start with the slug fully 'in' and adjust for maximum output (approximately 0.5V) and continue adjusting one more turn. (Single, 3 and 5 channel boards only. For 4, 8 and 12 channel boards use pins O/P and S).

ii) Connect a frequency counter to pins E & Es on the Receiver Oscillator Board. Adjust coil L4 for the correct operating frequency.

IF NO OUTPUT REGISTERED

v) Disconnect the socket from the Transmitter Multiplier Board and connect a valve voltmeter to the flying end, terminating in 50Ω. The reading obtained should be approximately 0.3V. If no or low output is recorded, the Transmitter Oscillator Board is faulty.

IF OUTPUT RECORDED

vi) Transfer valve voltmeter to the Transmitter Multiplier Board output terminals. The output should be approximately 2 volts. If no output is recorded the fault is within the Transmitter Multiplier Board.

IF OUTPUT RECORDED

vii) Transfer valve voltmeter to Transmitter Output Board input terminals. The reading obtained should be approximately 2 volts. If no output is recorded the fault is within the Transmitter Filter.

IF OUTPUT RECORDED

viii) Fault is within the Transmitter Output Board.

It may prove useful to note that if the total current drawn indicates the order of 1 amp, then it is likely that the Transmitter Output Board is being driven. But of course it cannot be assumed that the Transmitter Output Board is faulty.

3.5 BOARD REMOVAL

First remove the four retaining screws and withdraw the unit from the mounting case.

Referring to the photographic illustration remove the two quick release spade terminals from the loudspeaker audio output from the side board. Disconnect capacitor from body of Filter 8-LRU-492 and side board. Remove 4 microphone quick release spade terminals. Remove the two 4BA screws from side board adjacent to microphone input lead. Diagonally opposite this point a further 2 4BA screws must be removed from the other side board. Open out the equipment to form two separate units and remove the socket from the Transmitter Multiplier Board. Removal of any particular board may now be effected by simply unsoldering any connections to the sideboards and removing the two retaining screws.

3.6 SEMI-CONDUCTOR REPLACEMENT

A light emitting diode (L.E.D.) is used for "power on" indication. It is chosen for it's long life and trouble free characteristics.

A. Receiver

If the fault is within the receiver, the following procedure should be adopted:-

i) Check the 13.8V and 9V d.c. supplies. If incorrect the fault is within the power supply circuit.

IF CORRECT

ii) Set the U.H.F. signal generator to the required channel frequency using the frequency counter. Adjust the deviation for 5 or 15KHz, as required and set the output level to 100mV.

iii) Connect the generator to the aerial input socket and set the SQUELCH control fully clockwise and the VOLUME control to it's mid-position.

iv) Connect the oscilloscope across the loudspeaker terminals. If a signal output is registered reduce the input level to luV and should the output remain then the fault is either in the aerial or loudspeaker circuits.

IF NO OUTPUT

v) Transfer the oscilloscope to the pin on the SQUELCH control located nearest to the VOLUME control. An audio output should be displayed together with some noise. If signal is present the fault is on the Receiver Audio & Squelch Board.

IF NOT PRESENT

vi) Check that the oscillator is working by connecting a valve voltmeter to the output of the appropriate oscillator transistor. If no output is registered a detailed inspection of the crystal connection and other components should be carried out. If a spare crystal is available, this could be used to eliminate a crystal failure.

IF SIGNAL PRESENT

vii) Transfer valve voltmeter to potentiometer R13 on the Receiver I.F. Board and check for an output. If no signal registered the fault is within the coaxial connection between the oscillator and I.F. boards.

IF SIGNAL PRESENT

viii) Separate the receiver from the transmitter and connect the output of the signal generator to the input of the Receiver R.F. Board. If an audio output is now present this indicates a fault between the aerial socket and the input to the RF Board.

i) R.F. valve voltmeter (Boonton type 91DA).

ii) F.M. signal generator (Marconi type TF.1066B/1).

iii) Oscilloscope (Tektronix type 515A).

iv) Multirange meter (Avometer Model 8).

v) Modulation Monitor (Racal 409).

vi) Frequency counter (Racal type 806R) and U.H.F. converter (Racal type 803R).

vii) Thruline power meter (Termaline).

viii) Noise and Distortion Analyzer HP333A.

3.4 FAULT LOCATION

Before assuming that the MTR10-191 Mobile equipment is faulty, check that the external 13.8V d.c. supply is present and that the aerial and fuse connection are electrically correct.

The photographic illustration of the MTR10-191 mobile unit, (page 303) shows the location of the p.c. boards and other associated components in both the transmitter and receiver.

Should the transmitter or receiver be suspect, refer to the base station regarding transmission and/or reception. If neither unit is functioning the fault is most likely to be within either the aerial or d.c. power supply circuits and use of a multirange meter should assist isolation.

Board Descriptions & Maintenance

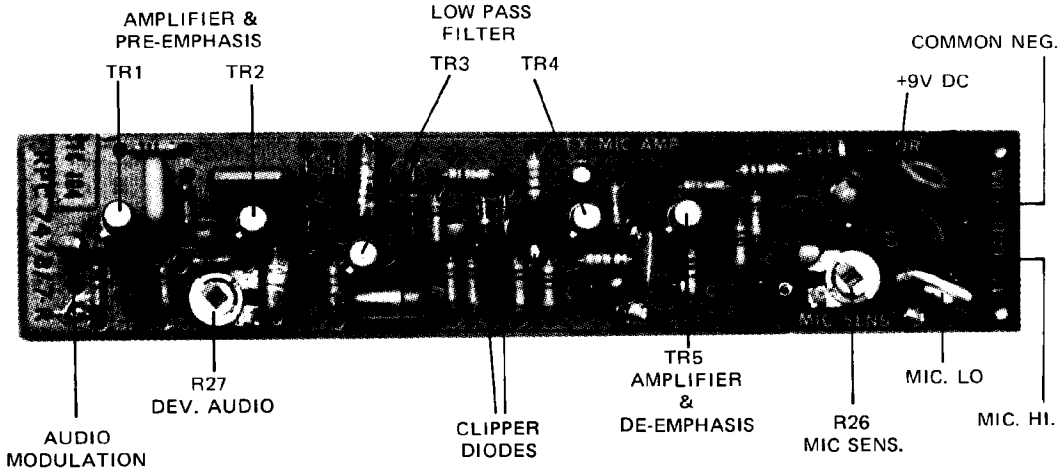
4.1 MICROPHONE AMPLIFIER BOARD ASSEMBLY

4.1.1 References

Circuit Diagram No.	Figure 3
Component Layout	See below
Manufacturing Code	342044 (17-LRU-158A)

The Microphone Amplifier Board is located within the Transmitter Unit as shown in the illustration on Page 303.

4.1.2 Description



MICROPHONE AMPLIFIER BOARD

The board is suitable for either a microphone or telephone line input within the frequency range 300 to 3000Hz. The microphone input level is controlled by potentiometer R26 which has no control on the telephone line input. Amplification and pre-emphasis is provided by the circuit using transistors TR1 and TR2.

The clipper circuit consisting of the diodes D1 and D2 and the biasing network R12 and R11, R13 is designed to limit at 300mV peak-to-peak signal level and prevents excessive modulation.

Transistors TR3 and TR4 and their associated resistance - capacitance networks are used in an active low-pass filter configuration which has a flat frequency response over the frequency range 300 to 3000Hz. The output stage contains the potentiometer R27 which is adjusted in conjunction with the modulator stage to produce the desired deviation.

To check the action of the clipper circuit apply an input of 20mV and check that the output waveform limits at the peaks.

The total current drawn by the board should measure approximately 5mA.

The table below indicates typical transistor d.c. voltages, measured with respect to earth using a multimeter.

Transistor (TR)	Emitter	Base	Collector
1	1.1	1.7	2.2
2	1.7	2.2	5.5 to 6.0
3	2.0	2.0	9.0
4	1.5	1.7	9.0
5	3.0	3.3	4.7

If the above information does not enable rapid location of a fault, the procedure detailed under TESTING should be carefully followed and any suspect results investigated.

4.1.5 Testing

A. Gain and Response Measurements

(i) Set potentiometers R26 and R27 fully clockwise and connect the impedance matching network to the board microphone input.

(ii) Connect the attenuator to the generator output and connect the attenuator output to the matching network.

(iii) Connect the valve voltmeter across the board input, connect the 9V d.c. supply, negative to common, and switch on.

(iv) Set the signal generator output frequency to 1000Hz and adjust the level for an indication of 100uV on the valve voltmeter.

(v) Transfer the valve voltmeter to the AUDIO MODULATION (board output) connection and record the reading. This should be approximately 10mV.

(vi) With an input of 100uV check the output voltages over the frequency range 300 to 3000Hz. The readings should be within +1 and -3db of that obtained in (v) above.

4.1.6 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Bypass	.01uF +80 -20% Cer. 250VW	MRC-CA33-610FSA	342937
C2	Coupling	.47uF +50 -20% 35VW	37C-CA52-147KRA	260434
C3	Bypass	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C4	Feedback	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C5	Bypass	1uF +50 -20% 35VW	37C-CA52-210FRA	260962
C6	Bypass	22uF +50 -20% 6VW	37C-CA52-322BRA	289701
C7	Decoupling	10uF +50 -20% 16VW	37C-CA52-310FRA	295223
C8	Feedback	1uF +50 -20% 35VW	37C-CA52-210FRA	260962
C9	Coupling	.47uF +50 -20% 35VW	37C-CA52-147KRA	260434
C10	Feedback	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C11	Bypass	22uF +50 -20% 6VW	37C-CA52-322BRA	289701
C12	Bypass	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C13	Coupling	.47uF +50 -20% 35VW	37C-CA52-147KRA	260434
C14	Bypass	.0022uF ± 5% 400VW	MRC-CA41-522HKC	342975
C15	Decoupling	.0022uF ± 5% 400VW	MRC-CA41-522HKC	342975
C16	Bypass	.01uF ± 5% 100VW	37C-CA43-610AKC	299085
C17	Decoupling	680pF ± 5% 400VW	MRC-CA41-468HKA	342974

Item	Circuit Function	Description	Other Reference	STC Part No.
R18	Emitter	3.3KΩ ± 5% CR25	MRC-RS12-333AMK	342917
R19	Part of L.P.Filter	15KΩ ± 2% MR25	MRC-RS15-415DFA	342889
R20	Part of L.P.Filter	15KΩ ± 2% MR25	MRC-RS15-415DFA	342889
R21	Part of L.P.Filter	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R22	Bias	47KΩ ± 5% CR25	MRC-RS12-447AMK	342904
R23	Bias	33KΩ ± 5% CR25	MRC-RS12-433AMK	342906
R24	Load	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R25	Emitter	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R26	Input	470Ω Var. Pot ± 20%	MRC-RS22-247DZA	342885
R27	Deviation	2.2KΩ Var. Pot ± 20%	MRC-RS22-322DZA	342884
		DIODES		
D1	Limiter	Silicon F/Child AN206	MRC-SD33-275AOA	342998
D2	Limiter	Silicon F/Child AN206	MRC-SD33-275AOA	342998
		FERRITE BEADS		
FB1	RF Decoupling TR1	Ferrite Core	FX3004	342882
FB2	RF Decoupling TR2	Ferrite Core	FX3004	342882
FB3	RF Decoupling TR3	Ferrite Core	FX3004	342882
FB4	RF Decoupling TR4	Ferrite Core	FX3004	342882
FB5	RF Decoupling TR5	Ferrite Core	FX3004	342882
		TRANSISTORS		
TR1	Pre-emphasis	Small Sig. Silicon	BC109A	295910
TR2	Pre-emphasis	Small Sig. Silicon	BC109A	295910

4.2 TRANSMITTER MULTIPLIER BOARD AND FILTER ASSEMBLIES

4.2.1 References

Multiplier Board

Diagram No.	Figure 4	
Manufacturing Code	270-LMU-3C	342182
Diagram No.	Figure 5	
Manufacturing Code	270-LMU-3A	342031

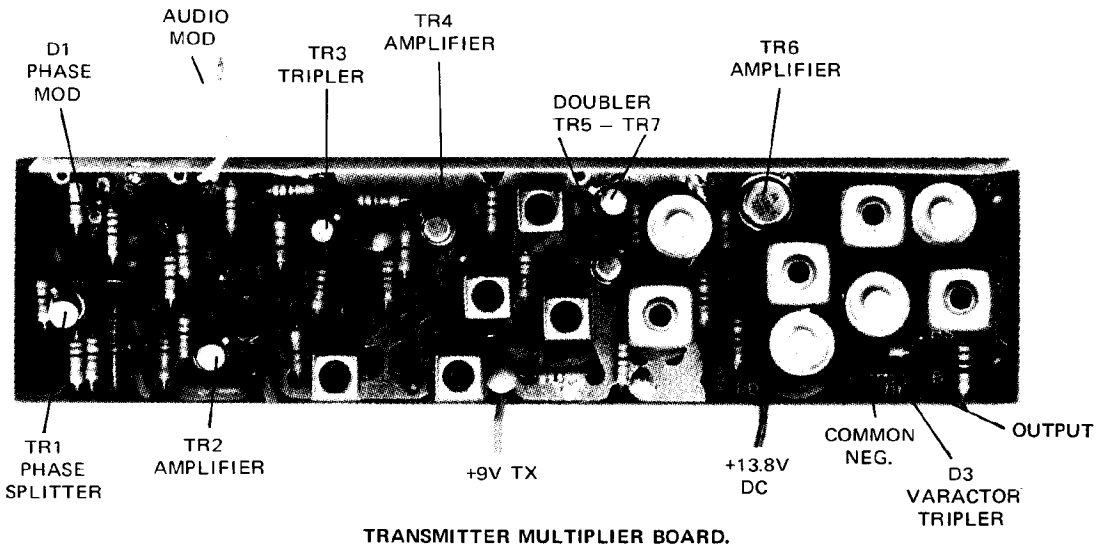
Filter

Diagram No.	Figure 6	
Manufacturing Code	8-LRU-492E	342183
Diagram No.	Figure 7	
Manufacturing Code	8-LRU-492A	342000

The Multiplier Board and Filter are located within the Transmitter Unit as shown by the illustration on page 303.

4.2.2 Description

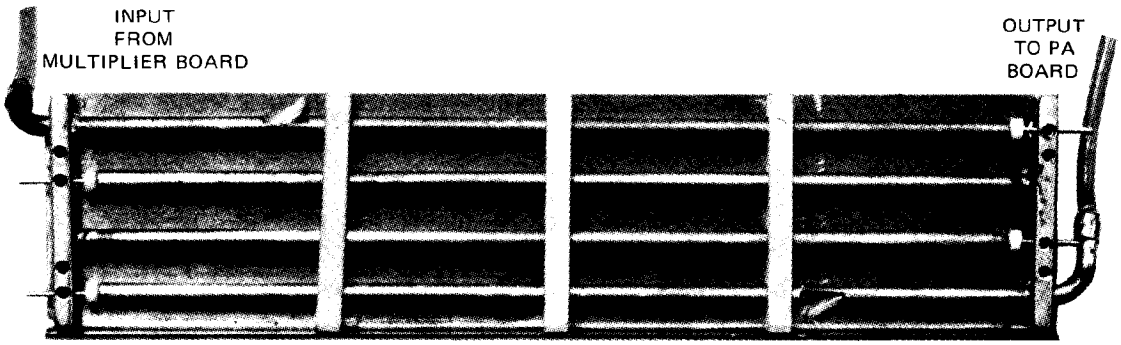
(A) Multiplier Board



TRANSMITTER MULTIPLIER BOARD.

(B) Filter 8-LRU-492E (403-420MHz)

Filter 8-LRU-492A (450-470MHz)



TRANSMITTER FILTER 8 - LRU - 492 A or E.
(SHOWING CONSTRUCTION)

The Filter is a 4 pole bandpass network having a passband of 20MHz and rejects harmonics generated in the multiplying stages of the Multiplier Board.

Passband	=	400 to 420MHz (342183) 450 to 470MHz (342000)
Input and output impedances	=	50Ω unbalanced
Loss attenuation in passband	=	1db approximately

4.2.3 Recommended Test Equipment

The following list includes recommended type of test instruments when it is required to carry out extensive tests on the board assembly. When the test equipment specified is not available equivalent types may be used.

i) Milliwattmeter (Hewlett Packard HP431B and HP478A thermistor mount) and 20db attenuator.

ii) Signal generator (Marconi TF801/D).

iii) Audio generator (Advance type J2).

iv) F.M. deviation meter (Airmec type 409).

v) Audio millivoltmeter (Advance type 77B).

vi) 13.8V d.c. limited to 100mA and 9V d.c. at 25mA regulated power supply.

vii) Swept display (Polyskop SWOB No. 2).

viii) RF Voltmeter (Boonton 91DA)

iii) Connect the RF voltmeter to the collector of TR5 and adjust the cores of L7 and L8 for maximum RF voltage at this collector.

iv) Connect an AVO meter Model 8 or equivalent (switched to the 2.5V d.c. scale) (+ ve) to the +13.8 volt line and (- ve) to the junction of R31 and R26.

v) Tune C33, L8, L7, L10, L11 and L12, in that order for a maximum on the AVO meter (800m volts).

vi) Tune C22, C24 and C23 in that order for a maximum power output on the power meter.

vii) Repeat the tuning of C33, L8, L7, L10, L11 and L12 and also C22, C24, and C23 for maximum power output on the power meter.

Note: In order to tune L8, L7, L10, L11 and L12 for maximum output it may be necessary to reduce the RF drive level. This may be done by loading the collector of TR3 by placing a finger on the TR3 heatsink or by bypassing the TR3 collector to the multiplier board shield with a small capacitor (5.6pf to 15pf).

During alignment any abrupt change (or popping) in output level will indicate spurious oscillation. Two conditions of misalignment will cause spurious oscillation.

(1) Misalignment of L8. The tuning of this inductor L8 must be carried out under the reduced drive condition and the core tuned to the top of can tuning point. After determining the alignment point for maximum power output turn the core one-half turn further clockwise.

(2) If two asymmetrical maximum power outputs are observed when tuning C24 the smaller maximum which occurs at the higher capacitance value must be used as the larger maximum may indicate a spurious output.

viii) Readjust the signal generator to the carrier frequency and check that the milliwattmeter indication is within the range of 100-200mW.

(C) Deviation Check

i) Replace the milliwattmeter by the deviation meter and connect the audio generator to the audio input. Monitor the audio input level using the audio millivoltmeter.

If the table does not enable rapid location of a fault, the procedure detailed under TESTING should be carefully followed and any suspect results investigated.

4.2.5 Testing

CAUTION - No attempt should be made to readjust the filter. If operation is suspect the unit should be returned to the manufacturer.

MULTIPLIER BOARD (TRANSMITTER) & FILTER ASSEMBLY 270-LMU-3A

4.2.6 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Coupling	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C2	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C3	Coupling	20pF ± 5% 500VW	MRC-CA33-320CKA	342944
C4	Coupling	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C5	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C6	Bypass	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C7	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C8	Coupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C9	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C10	Coupling	2.2pF ± .25pF 63VW	MRC-CA33-2220BA	342966
C11	Coupling	2.2pF ± .25pF 63VW	MRC-CA33-2220BA	342966
C12	Coupling	1.8pF ± .25pF 63VW	MRC-CA33-2180BA	342967
C13	Coupling	3.3pF ± .25pF 63VW	MRC-CA33-2330BA	342965
C14	Decoupling	4.7uF Tant. 25VW	TAG	260440
C15	Pad	10pF ± .25pF 63VW	MRC-CA33-3100BA	342964
C16	Pad	12pF ± 2% 63VW	MRC-CA33-3120BA	342963
C17	Pad	12pF ± 2% 63VW	MRC-CA33-3120BA	342963

Item	Circuit Function	Description	Other Reference	STC Part No.
L3	TR6-Load	Coil	MR270-LRU-42-D6	342039
L4	Not Used			
L5	Part of Tripler Circuit	Coil	MRC-CL00-999ZDV	342035
L6	Part of Tripler Circuit	Coil	MR270-LRU-42-D7	342040
L7	TR4-Load	Coil	MRC-CL00-999ZDM	342037
L8	TR4-Amp	Coil	MRC-CL00-999DZN	342038
L9	Choke	1mH 5810002310	MRC-CL00-41000A	342876
L10	Filter	Inductor Coil	MRC-CL00-999ZDM	342037
L11	Filter	Inductor Coil	MRC-CL00-999ZDM	342037
L12	Filter	Inductor Coil	MRC-CL00-999ZDM	342037
L13	Part of TR3-Load	22uH (Inductor Choke)	MRC-CL00-22200B	342878
		RESISTORS		
R1	Not Used			
R2	Matching	47 ohm ± 5% CR25	MRC-RS12-147AMK	342932
R3	Bias	10K ohm ± 5% CR25	MRC-RS12-410AMK	342911
R4	Base	2.2K ohm ± 5% CR25	MRC-RS12-322AMK	342918
R5	Load	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R6	Emitter	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R7	Not Used			
R8	Bias	47K ohm ± 2% CR25	MRC-RS14-447EFA	342853
R9	Bias	15K ohm ± 5% CR25	MRC-RS12-415AMK	342910
R10	Bias	6.8K ohm ± 5% CR25	MRC-RS12-368AMK	342913
R11	Emitter	470 ohm ± 5% CR25	MRC-RS12-247AMK	342924

Item	Circuit Function	Description	Other Reference	STC Part No.
		TRANSFORMERS		
T1	Tuned Coupling	Coil Assy	MRC-CL00-999ZDY	342036
		TRANSISTORS		
TR1	Phase Splitter	Silicon NPN (2N918)	MPS918	260215
TR2	Amplifier	Silicon NPN (2N918)	MPS918	260215
TR3	Tripler	Silicon NPN (MM1941)	MRC-ST31-036AOA	342994
TR4	Amplifier	Silicon NPN (BF173)	MRC-ST31-035FOA	342997
TR5	Doubler	Silicon NPN (BSX19)	MRC-ST31-034AOM	342996
TR6	Amplifier	Silicon NPN (2N4427)	MRC-ST31-113FOB	342995
TR7	Doubler	Silicon NPN (BSX19)	MRC-ST31-034AOM	342996
		DIODES		
D1	Phasing	Switching Diode HP.5082-3082	MRC-SD33-311ABA	342993
D2	Clamping	Switching Diode AN206	MRC-SD33-375AOA	342998
D3	Vari-cap	Power Silicon (FRB124)	MRC-SD73-080AOA	342992
		MISCELLANEOUS		

Note: The under mentioned filter is connected between the multiplier and P.A. stages and appears as a separate item. See drawing Fig. No. 5.

Fig.5	Filter	4 Pole Bandpass Network 20MHz	8LRU-492A	342000
	Filter	for 403-420MHz Band	8LRU-492E	342183

4.3 TRANSMITTER POWER OUTPUT AMPLIFIER ASSEMBLY

4.3.1 References

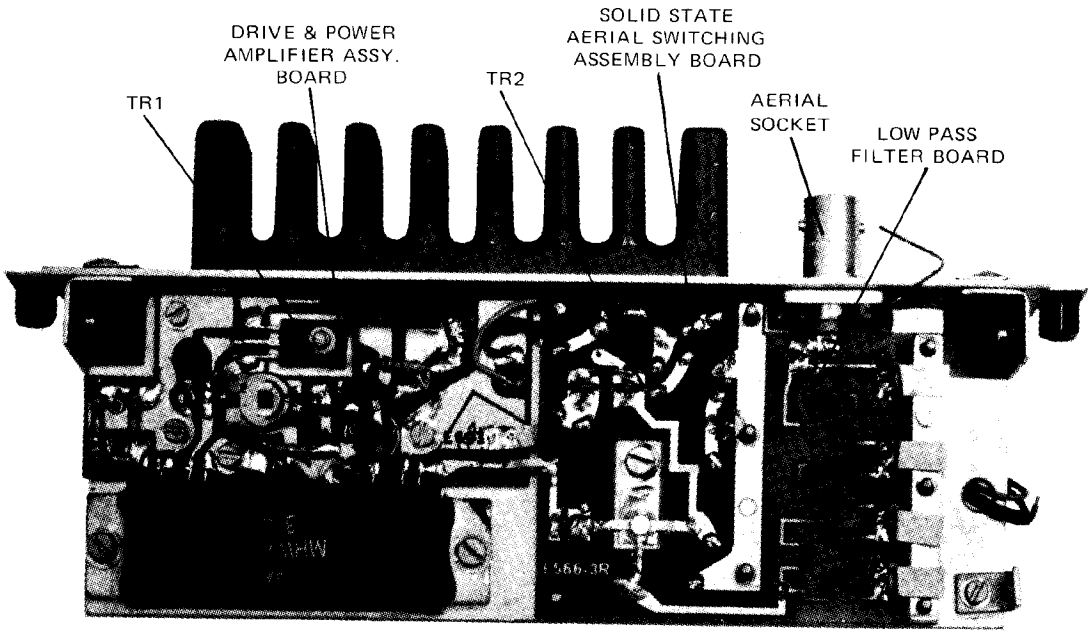
Diagram No.	Figure 8
Manufacturing Code	28-LMU-17A (342440)
Diagram No.	Figure 9
Manufacturing Code	28-LMU-17C (342186)

The Power Output Amplifier Assembly is located within the Transmitter Unit as shown by the illustration on page 303 Section 3.

WARNING

The output stage has been designed to operate safely with a wide variation of output loading impedance. However, it is strongly recommended that the Transmitter Output Board should not be operated for long periods of time in the absence of a suitable load.

4.3.2 Description



TRANSMITTER POWER OUTPUT AMPLIFIER ASSEMBLY

The Transmitter output assembly consists of a power amplifier, lowpass filter, aerial switching circuit and drive control circuit.

inductors L1 and L2 thus providing a complete circuit from the power amplifier output to the antenna. The insertion loss of the diode switch is less than 0.3db at the switching current value used and the isolation between the transmit and receive parts is 20 db.

When the press-to-talk (transmit) function is cancelled diode D5 becomes non conducting the transistor TR2 conducts via R8, L3 and the receive diode D6 and inductor L2 thus providing a complete radio frequency path from the antenna to the receiver via the isolating capacitors C11 and C6 and the low pass filter.

Capacitors C12, C13, C14 and C15 provide a radio frequency connection between the common negative rail and the chassis of the unit.

Input frequency	=	400-420MHz & 450-470MHz
Input level	=	approximately 150mW
Input Impedance	=	50Ω unbalanced
Output power	=	10 watts
Output impedance	=	50Ω unbalanced

4.3.3 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to conduct extensive tests on the amplifier assembly. When the test equipment specified is not available, equivalent types may be used.

i) Milliwattmeter (Hewlett Packard HP.431B) and 30db 5W attenuator (Sierra).

ii) Signal Generator (Marconi TF.801/D).

iii) Power Amplifier (Boonton) Type 230A and 6db pad (Greenpar).

iv) Sensitive R.F. voltmeter (Booton 91DA) and 50Ω BNC adaptor.

v) Thru-line Wattmeter (Bird type 43 with 1 watt insert).

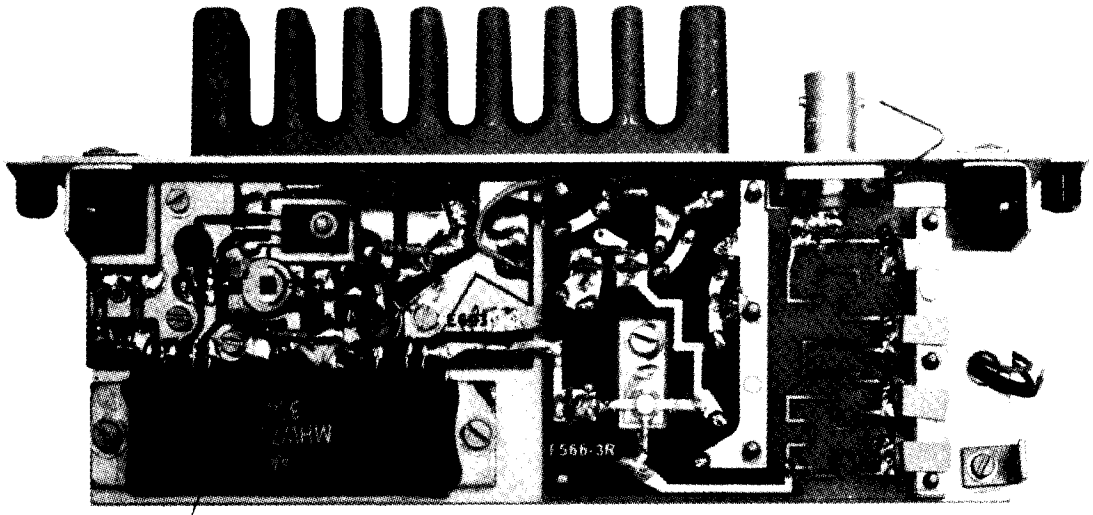
vi) Multimeter (Avometer Model 8).

vii) 13.8V d.c. limited at 1A and 9V d.c. at 25mA, power supply.

4.3.4 Fault Location

All measurements are to be regarded as typical.

4.3.5 Testing



The 10w Power Amplifier Module TFC1
is fully described on Page 424

A. Amplifier Assembly Test

i) Connect the milliwattmeter to the antenna socket via the 30 db attenuator.

ii) Connect the signal generator to the P.A. Assembly input, via the power amplifier, 6db pad and thru-line wattmeter.

iii) Apply +9V d.c. to 9V Tx point.

iv) With the signal generator set for zero output, connect the 13.8V d.c. supply to the Output Assembly. Monitor the d.c. supply and check that the total current does not exceed 30mA drawn from the +9V d.c. supply, and zero from the 13.8V d.c. supply.

v) Increase the signal generator output level to 50mW at centre frequency of UHF band specified MHz and check for an indication on the milliwattmeter.

iv) Connect a signal generator to the antenna socket set to the centre frequency of the band at 50mV p.d. Check that the RF voltmeter reading is not less than 20mV p.d.

4.3.6 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Decoupling	.01uF +50 -25% 25VW	MRC-CA33-6100RW	342823
C2	Decoupling	.01uF +50 -25% 25VW	MRC-CA33-6100RW	342823
C3	Decoupling	1000pF +80 -20% 250VW	MRC-CA33-510FSA	342827
C4	Decoupling	1000pF +80 -20% 250VW	MRC-CA33-510FSA	342827
C5	Decoupling	1000pF +80 -20% 250VW	MRC-CA33-510FSA	342827
C6	Coupling	1000pF +80 -20% 250VW	MRC-CA33-510FSA	342827
C7	Filter	3.9pF ± 0.5pF 350VW	MRC-CA33-239JCD	342825
C8	Filter	10pF ± 0.5pF 350VW	MRC-CA33-310JCX	342824
C9	Filter	10pF ± 0.5pF 350VW	MRC-CA33-310JCX	342824
C10	Filter	2.7pF ± 0.5pF 350VW	MRC-CA33-227JCA	342826
C11	Coupling	1000pF +80 -20% 250VW	MRC-CA33-510FSA	342827
C12	DC Blocking	1000pF +100 -20% 500VW	MRC-CA33-510JTD	342828
C13	DC Blocking	1000pF +100 -20% 500VW	MRC-CA33-510JTD	342828
C14	DC Blocking	1000pF +100 -20% 500VW	MRC-CA33-510JTD	342828
C15	DC Blocking	1000pF +100 -20% 500VW	MRC-CA33-510JTD	342828
		INDUCTORS		
L1	R.F. Choke	.22uH Inductor 5810000110	MRC-CL00-02200D	342880

Item	Circuit Function	Description	Other Reference	STC Part No.
D4	Volt Reg.	Diode BZY88-C8V2	MRC-SD23-182ABA	342818
D5	Switch	Diode 5082-3391-HP	MRC-SD33-320ABA	342819
D6	Switch	Diode 5082-3391-HP	MRC-SD33-320ABA	342819
D7	Protection	Diode BA244	MRC-SD33-215AOB	351501

4.4 TRANSMITTER/RECEIVER OSCILLATOR BOARD ASSEMBLY

4.4.1 Single Channel

The oscillator boards provide three outputs and these are tabulated below together with their functions.

a) 22.22 to 23.33MHz or 25.0 to 26.1MHz to supply the phase modulator stage on the transmitter multiplier board.

b) 91.26 to 95.70MHz or 106.2 to 111MHz C.W. to supply the first mixer stage via further multiplication on the Receiver RF board.

c) 45.63 to 47.85MHz or 35.4 to 37.0MHz C.W. to supply the second mixer stage on the Receiver IF board.

4.4.2 Brief Description

In a single channel equipment the transmitter and receiver are supplied from a single board mounting two quartz crystals together with their associated circuitry.

References

Title	Transmitter/Receiver Oscillator Board
Diagram No.	Figure 10
Manufacturing Code	342184 (16-LRU-362AG)
Diagram No.	Figure 11
Manufacturing Code	342103 (16-LRU-362A)

NOTE

Crystals should be ordered in accordance with STC Specification No. 1011 Type QC42.

The Transmitter/Receiver Oscillator Board is located within the equipment as shown by the illustration on page 308.

tuned to the required output frequency. The second mixer output is transformer coupled to the Receiver I.F. Board via transistor amplifier buffer TR4. Diode D1, biases transistor TR5 to provide an output rich in third harmonic content. The first mixer output is transformer coupled to the Receiver R.F. Board.

Crystal XL2 is supplied according to frequency allocation and may be calculated from the following expression:-

$$\text{Crystal frequency} = \frac{\text{Receiver operating freq. } +10.7}{9} \text{ MHz}$$

(400-420MHz band)

$$\text{Crystal frequency} = \frac{\text{Receiver operating freq. } +10.7}{13} \text{ MHz}$$

(450-470MHz band)

4.4.4 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to conduct extensive tests on the board assembly. When the test equipment specified is not available equivalent types may be used.

i) Multimeter (Avometer Model 8)

ii) Sensitive R.F. voltmeter (Boonton 91DA)

iii) 9V d.c. limited at 50mA power supply

4.4.5 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the Transmitter/Receiver Oscillator Board reference should be made to Section 3.2 page 301 for information regarding the use of soldering irons and measurements of transistor junction resistances.

If the Transmitter Oscillator is faulty on a combined Transmitter/Receiver Oscillator Board, check the 9V d.c. supply. The total current drawn should be approximately 16mA. Disconnect the coaxial lead from the Multiplier Board and terminate in 50 ohms. Connect a valve voltmeter to points A & As. The reading obtained should be approximately 0.25V into 50 ohms.

The table below indicates d.c. voltages with respect to earth, using a multimeter Avometer Model 8.

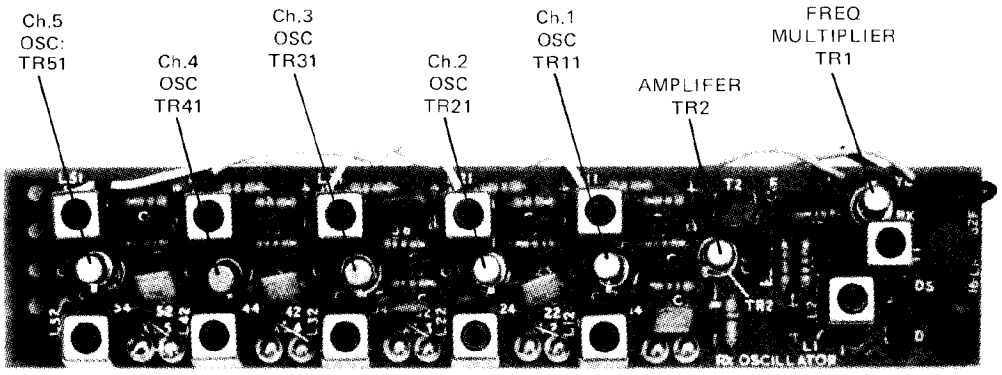
check for an indication of the valve voltmeter at the secondary of transformer T2. If an output is obtained, tune coil L3 for maximum indication, starting with the core nearest the printed circuit board, and then turn the core one more turn counter clockwise. Connect a frequency counter to the output and adjust coil L4 for the correct frequency. If no output is obtained check the coils and transformers for continuity. If the above checks do not enable isolation of a fault, a detailed check for each component should be carried out.

4.4.6 Multi Channel Equipments

In the multi channel MTR10-191 series radiotelephone for three or five channels the transmitter and receiver are supplied from separate boards which mount the crystal oscillators.

References

Title	Transmitter Oscillator Board
Diagram No.	Figure 12
Manufacturing Code	16-LRU-362BJ 3 channel 16-LRU-362BL 5 channel
Diagram No.	Figure 13
Manufacturing Code	16-LRU-362C 3 channel 16-LRU-362E 5 channel
Title	Receiver Oscillator Board
Diagram No.	Figure 14
Manufacturing Code	16-LRU-362BK 3 channel 16-LRU-362BM 5 channel
Diagram No.	Figure 15
Manufacturing Code	16-LRU-362D 3 channel 16-LRU-362F 5 channel



5 CHANNEL OSCILLATOR RECEIVER 450–470 MHz.

The operation of the receiver oscillator board is similar to that of the transmitter oscillator board. The output to the receiver intermediate frequency board is from the secondary winding of transformer T2. Diode D1 biases transistor TR1 to provide an output rich in third harmonic content. The first mixer output is coupled by a tuned bandpass filter to the receiver radio frequency board.

The crystal frequencies are allocated in the range 35.438460 to 36.976920MHz for the band 450 to 470MHz and may be calculated from the following expression.

$$\text{Crystal frequency} = \frac{\text{Receiver operating frequency} + 10.7\text{MHz}}{13}$$

For the band 400 to 420MHz, crystal frequencies are in the range 45.633333 to 47.855555MHz and expression for crystal frequency is:

$$\text{Crystal frequency} = \frac{\text{Receiver operating frequency} + 10.7\text{MHz}}{9}$$

4.4.8 Fault Location (Multi-channel)

The recommended test equipment and the method of fault location is similar to that described for the single channel transmitter/receiver oscillator board.

The buffer and multiplier stages can be rapidly checked by connecting a valve voltmeter to the board output and rotating the channel selector switch. If no indication is obtained this is probably due to a

The transmitter oscillator board mounts eight or twelve oscillator circuits permitting selection of one of any of the frequencies concerned. Selection of a particular oscillator is achieved by switching the common negative to the appropriate circuit. The oscillator circuits are arranged in groups of four, the output from each group being taken from the collector of the transistor oscillator to the base circuit of the common buffer amplifier transistor TR1.

Channel one oscillator contains the crystal XL1 the variable Capacitor C11 for adjustment of the correct oscillating frequency and the pulling coil L11. If for example channel one is selected the emitter circuit of TR2 is completed via the diode D11 and resistor R12 thus permitting oscillation to occur at the crystal frequency. Diode D201 also conducts via the series resistor R11 and the diodes D21, D31 and D41 are reversed biased via the series resistors R21, R31 and R41.

The transistor TR2 is biased by the resistor network R201 and R202 and the resistor R205 decouples the collector circuit of TR2 from the remaining collector circuits and couples the oscillator output to the common amplifier (TR1) input circuit. The tuning capacitor C203 permits the oscillation to be optimised.

The transformer T201 provides for feedback between the collector and emitter circuits.

The output of the buffer amplifier is coupled to the output termination by the wideband transformer T1.

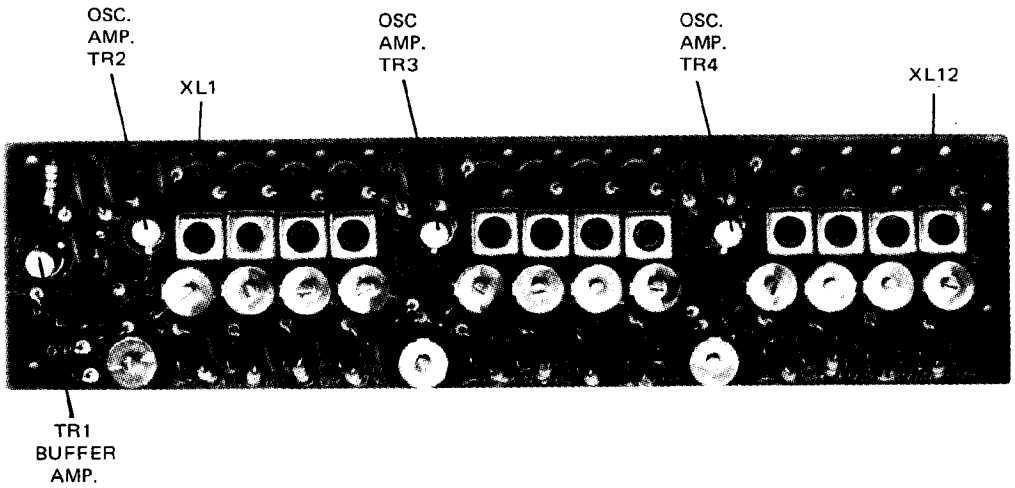
The crystal frequencies are allocated in the range 25.000000 to 26.111111MHz for the 450 to 470MHz band and in the range 22.222222 and 23.333333MHz for the 400-420MHz band and may be calculated from the following expression.

$$\text{Crystal frequency} = \frac{\text{Transmitter output frequency}}{18} \text{ MHz}$$

Test Point	Volts D.C. 16-LMU-7A & E	16-LMU-7B & F
TR1 emitter	1.3	
TR1 base	2.1	
TR1 collector	9	
TR2 emitter	3.1	3.1
TR2 base	3.7	3.7
TR2 collector	8.6	8.6
TR3 emitter	3.1	3.1
TR3 base	3.7	3.7
TR3 collector	8.6	8.6
TR4 emitter	0.55	0.55
TR4 base	1.2	1.2
TR4 collector	9	9

If the measurements made are not very different from these above set the five frequency adjusting cores of the inductors L1, L21 etc. so that the top of the core is level with the top of the coil former and with a frequency counter connected to the output of the board adjust the capacitors C11, C21 etc. for correct frequency and make the final adjustment by means of the fine tuning adjustments L1, L21 etc. The capacitors C203, C303 etc. are adjusted for maximum output.

If no output is obtained check the coils and transformers for continuity. If the above checks do not enable isolation of a fault, a detailed check of each component should be conducted.



12 CHANNEL OSCILLATOR BOARD
16 - LMU - 7

The four channel oscillator board mounts two groups of four oscillator circuits permitting selection of one of any of the frequencies concerned. Selection of a particular oscillator is achieved by switching the common negative to the appropriate circuit. The output from each group is taken from the collector of the transistor oscillator to the base circuit of the respective buffer amplifier transistor TR1 or TR4.

Channel one transmitter oscillator contains the crystal XL1 the variable Capacitor C11 for adjustment of the correct oscillating frequency and the pulling coil L11. If for example channel one is selected the emitter circuit of TR2 is completed via the diode D11 and resistor R12 thus permitting oscillation to occur at the crystal frequency. Diode D201 also conducts via the series resistor R11 and the diodes D21, D31 and D41 are reversed biased via the series resistors R21, R31 and R41.

The transistor TR2 is biased by the resistor network R201 and R202 and the resistor R205 couples the oscillator output to the amplifier (TR1) input circuit. The tuning capacitor C203 permits the oscillation to be optimised.

The transformer T201 provides for feedback between the collector and emitter circuits.

The output of the buffer amplifier is coupled to the output termination by the wideband transformer T1.

The crystal frequencies are allocated in the range 25.000000 to 26.111111MHz for the 450 to 470MHz band and in the range 22.222222 and 23.333333MHz for the 400-420MHz band and may be calculated from the following expression.

$$\text{Crystal frequency} = \frac{\text{Transmitter output frequency}}{18} \text{ MHz}$$

The operation of the receiver oscillator group is similar to that of the transmitter oscillator group. The output of the receiver oscillator group provides the input to the buffer amplifier TR4. The output from

Test Point	Volts D.C. 16-LMU-8C	16-LMU-8E
TR2 emitter	3.1	3.1
TR2 base	3.7	3.7
TR2 collector	8.6	8.6
TR3 emitter	3.1	3.1
TR3 base	3.7	3.7
TR3 collector	8.6	8.6
TR4 emitter	0.55	0.55
TR4 base	1.2	1.2
TR4 collector	9	9
TR5 emitter	0	0
TR5 base	0.6	0.6
TR5 collector	8	8

If the measurements made are not very different from these above set the fine frequency adjusting cores of the inductors L1, L21 etc. so that the top of the core is level with the top of the coil former and with a frequency counter connected to each output of the board, in turn, adjust the capacitors C11, C21 etc. for correct frequency and make the final adjustment by means of the fine tuning adjustments L1, L21 etc. The capacitors C203 and C303 etc. are adjusted for maximum output.

If no output is obtained check the coils and transformers for continuity. If the above checks do not enable isolation of a fault, a detailed check of each component should be conducted.

The receiver multiplier of the four channel oscillator can be checked by terminating the output termination O/P and S in a 1000Ω resistor and measuring the output with an RF watt meter. This output should exceed 1.0 volt r.m.s. when T501 and L502 are adjusted for maximum output.

4.4.17 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C2	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C3	Bypass	5.6pF ± .5pF 500VW	MRC-CA33-256JCB	342951
C4	Coupling	8.2pF ± .5pF 500VW	MRC-CA33-282JCB	342949
C5	Crystal Trimming	18pF ± 5% 500VW	MRC-CA33-318JKA	342945
C6	Crystal Trimming	150pF ± 2% 100VW	MRC-CA33-415AKA	342958
C7	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C8	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C9	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C10	Bypass	5.6pF ± .5pF 500VW	MRC-CA33-256JCB	342951
C11	Coupling	8.2pF ± .5pF 500VW	MRC-CA33-282JCB	342949
C12	Crystal Trimming	12pF ± 5% 500VW	MRC-CA33-312JKC	342946
C13	Crystal Trimming	100pF ± 2% 100VW	MRC-CA33-410AKA	342854
C14	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C15	Coupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C16	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C17	Pad	7.5pF ± .5pF 500VW	MRC-CA33-275JCA	342950

Item	Circuit Function	Description	Other Reference	STC Part No.
		TRANSFORMERS		
T1	Amplifier Coupling	Inductor Coil	MRC-CL00-999ZDW	342105
T2	Amplifier Coupling	Inductor Coil	MRC-CL00-999ZDW	342105
T3	Tuned Coupling	Inductor Coil	MRC-CL00-999ZDF	342111
		TRANSISTORS		
TR1	Tx Oscillator	Silicon NPN	2N918	260215
TR2	Amplifier	Silicon NPN	2N918	260215
TR3	Rx Oscillator	Silicon NPN	2N918	260215
TR4	Amplifier	Silicon NPN	2N918	260215
TR5	Freq. Doubler	Silicon NPN	2N918	260215
		DIODES		
D1	Bias	Diode Switching Silicon	MRC-SD33-375AOB	342989
		FERRITE BEADS		
FB1	RF Decoupling	Coretube Ferroxcube	FX1242	203742
FB2	RF Decoupling	Coretube Ferroxcube	FX1242	203742

MULTI-CHANNEL OSCILLATOR BOARDS 8 & 12 CHANNEL — 16-LMU-7 342126-131

4.4.18

		CAPACITORS		
C1	Coupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C2	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C11	Trimmer	2-22pF Variable	2222.808.00006	342852

Item	Circuit Function	Description	Other Reference	STC Part No.
C203	Trimmer	2-22pF Variable	2222.808.00006	342852
C301	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C302	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C303	Trimmer	2-22pF Variable	2222.808.00006	342852
C401	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C402	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C403	Trimmer	2-22pF Variable	2222.808.00006	342852
		INDUCTORS		
L1	Osc:Tuning	Inductor Coil AAW		342115
L21	Osc:Tuning	Inductor Coil AAW		342115
L31	Osc:Tuning	Inductor Coil AAW		342115
L41	Osc:Tuning	Inductor Coil AAW		342115
L51	Osc:Tuning	Inductor Coil AAW		342115
L61	Osc:Tuning	Inductor Coil AAW		342115
L71	Osc:Tuning	Inductor Coil AAW		342115
L81	Osc:Tuning	Inductor Coil AAW		342115
L91	Osc:Tuning	Inductor Coil AAW		342115
L101	Osc:Tuning	Inductor Coil AAW		342115
L111	Osc:Tuning	Inductor Coil AAW		342115
L121	Osc:Tuning	Inductor Coil AAW		342115
		RESISTORS		
R1) R2) R3)	Part of Base Bias	For value of these resistors - refer table on Circuit Diagram		
R11	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R12	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R13	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921

Item	Circuit Function	Description	Other Reference	STC Part No.
R82	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R83	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R91	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R92	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R93	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R101	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R102	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R103	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R111	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R112	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R113	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R121	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R122	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R123	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R201	Bias	4.7KΩ ± 5% Carb. Film	MRC-RS12-347AMK	342916
R202	Bias	4.7KΩ ± 5% Carb. Film	MRC-RS12-347AMK	342916
R203	Damping	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R204	Decoupling	47Ω ± 5% Carb. Film	MRC-RS12-147AMK	342932
R205	Isolating	1.5KΩ ± 5% Carb. Film	MRC-RS12-315AMK	342919
R301	Bias	4.7KΩ ± 5% Carb. Film	MRC-RS12-347AMK	342916

Item	Circuit Function	Description	Other Reference	STC Part No.
		DIODES		
D11	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D21	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D31	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D41	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D51	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D61	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D71	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D81	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D91	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D101	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D111	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D121	Switching	Switching Silicon	MRC-3D33-375AOB	342989
D201	Bias	Switching Silicon	MRC-3D33-375AOB	342989
D301	Bias	Switching Silicon	MRC-3D33-375AOB	342989
D401	Bias	Switching Silicon	MRC-3D33-375AOB	342989

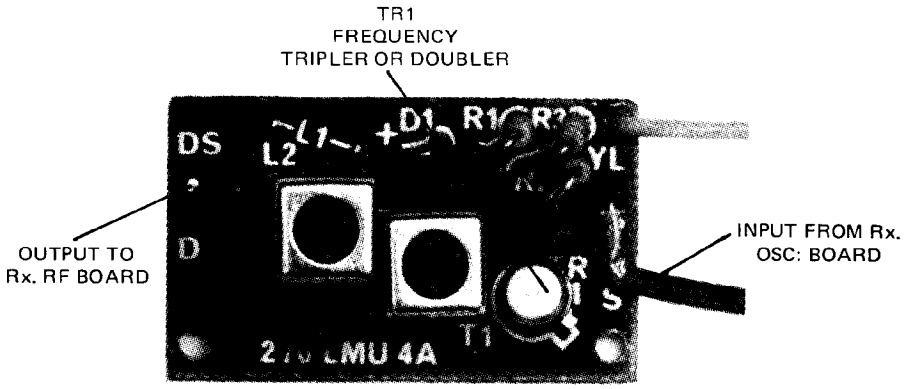
4.5 RECEIVER MULTIPLIER BOARD

4.5.1 References

Title	Receiver Multiplier Board
Diagram No.	Figure 29
Manufacturing Code	342461 (270-LMU-4A)
	342185 (270-LMU-4C)

The transmitter multiplier board receives an output from the eight or twelve channel oscillator board and provides frequency multiplication to produce an output which is used for the generation of the required local oscillator input for the receiver first mixer stage.

4.5.2 Description



SEE TABLE FIG. 29
RECEIVER MULTIPLIER BOARD

The receiver frequency multiplier can be used either as a doubler or tripler depending on the requirement of the receiver local oscillator. The transistor TR1 is biased by the diode D1 to provide an output rich in third harmonic content.

The collector tuned bandpass filter consisting of T1, L1, L2 and capacitors C3, C4, C5 rejects the unwanted harmonics and couples the output to the output terminations D and DS.

4.5.3 Recommended Test Equipment

The following list includes the recommended types of test instruments when it is required to conduct extensive tests on the board assembly. When the test equipment

4.5.5 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Coupling	.01uF +80 -20% CER	MRC-CA33-610FSA	342937
C2	Decoupling	.01uF +80 -20% CER	MRC-CA33-610FSA	342937
C3	Pad.	See Table	Details on	
C4	Pad.	below	Circuit Diagram	
C5	DC Block	32pF	MRC-CA33-610FSA	342941

Table of Capacitor Values

Group	C3 Value	DP No.	C4 Value	DP No.
270-LMU-4A	10pF	342947	12pF	342946
270-LMU-4C	7.5pF	342950	9pF	342948

		INDUCTORS		
L1	Tuning	Inductor	Short Length TCW	-
L2	Tuning	Inductor	MRC-CL00-999ZDE	342110
		RESISTORS		
R1	Bias	6.8KΩ CR25	MRC-RS12-368ANK	342913
R2	Bias	2.2KΩ CR25	MRC-RS12-322ANK	342918
R3	Bias	100 Ω CR25	MRC-RS12-210ANK	342930
		TRANSISTORS		
TR1	Amplifier	2N918 (2N2368)	MRC-ST31-036E0C	206215
		DIODES		
D1	Bias	1N4148 SW	MRC-SD33-375A0B	342989
		TRANSFORMERS		
T1	Tuned Coupling		MRC-CL00-999ZDF	342111

4.5.5 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Coupling	.01uF +80 -20% CER	MRC-CA33-610FSA	342937
C2	Decoupling	.01uF +80 -20% CER	MRC-CA33-610FSA	342937
C3	Pad.	See Table	Details on	
C4	Pad.	below	Circuit Diagram	
C5	DC Block	32pF	MRC-CA33-610FSA	342941

Table of Capacitor Values

Group	C3 Value	DP No.	C4 Value	DP No.
270-LMU-4A	10pF	342947	12pF	342946
270-LMU-4C	7.5pF	342950	9pF	342948

		INDUCTORS		
L1	Tuning	Inductor	Short Length TCW	-
L2	Tuning	Inductor	MRC-CL00-999ZDE	342110
		RESISTORS		
R1	Bias	6.8KΩ CR25	MRC-RS12-368ANK	342913
R2	Bias	2.2KΩ CR25	MRC-RS12-322ANK	342918
R3	Bias	100 Ω CR25	MRC-RS12-210ANK	342930
		TRANSISTORS		
TR1	Amplifier	2N918 (2N2368)	MRC-ST31-036E0C	206215
		DIODES		
D1	Bias	1N4148 SW	MRC-SD33-375A0B	342989
		TRANSFORMERS		
T1	Tuned Coupling		MRC-CL00-999ZDF	342111

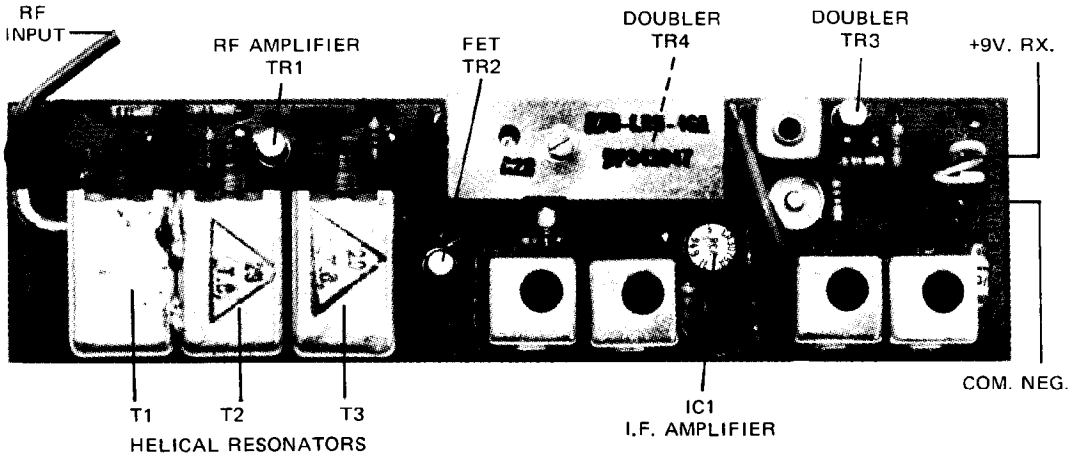
4.6 RECEIVER RF BOARD ASSEMBLY

4.6.1 Reference

Diagram No.	Figure 16
Manufacturing Code	342437 (28-LRU-791E)
	Figure 17
	342058 (28-LRU-791A)

The IF Board is located as shown by the illustration on page 303.

4.6.2 Brief Description



RECEIVER R.F. AMPLIFIER

The board will accept a frequency modulated input within the frequency range 400-420MHz or 450-470MHz as specified. The input circuit comprises two critically coupled helical resonators, T1 and T2. The R.F. amplifier circuit is a grounded base transistor TR1 which ensures low noise amplification. Resonator T3 couples the R.F. amplifier to the first mixer stage.

The first mixer is a dual gate MOS FET transistor. The amplified received signal input, is applied to Gate No. 1. The local oscillator input, is applied to Gate No. 2. The resultant I.F. occurring at the drain connection is filtered by the bandpass coils L2 and L3 and then amplified by integrated circuit module IC1 preceding the final bandpass filter coils L4 and L5. All circuits are tuned to peak at the channel centre-frequency.

The local oscillator input is obtained by direct multiplication of the oscillator input. Transistors TR3 and

Test Point	Voltage
R8/C7	8.4
IC1 pin 2	2.7
IC1 pin 4	2.0
IC1 pin 5	5.5
IC1 pin 7	8.0
R12/D1	0.6

If the above d.c. measurements do not enable isolation of a fault, the board should be checked under signal conditions. With an R.F. input at a level of 1 volt to OSC. INPUT, the voltage across resistor R13 should measure approximately 0.5V d.c. If the multipliers are tuned correctly the total d.c. current should measure approximately 33mA. If the multipliers are off tune the current will measure approximately 27.5mA. If the fault lies within either the R.F. or I.F. sections a valve voltmeter should be used, progressing from stage to stage, and any suspect results investigated.

4.6.5 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Coupling	100pF ± 10% 200VW	MRC-CA33-410ELD	342939
C2	Decoupling	.001uF ± 10% 200VW	MRC-CA33-510JSG	342938
C3	Bypass	100pF ± 10% 200VW	MRC-CA33-410ELD	342939
C4	Coupling	.001uF ± 10% 200VW	MRC-CA33-510JSG	342938
C5	Tuning	93pF (Part of Assy L2)		
C6	Bypass	33pF ± 5% 200VW	MRC-CA33-333EKA	342940
C7	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C8	Coupling	1.5pF ± .1pF 500VW	MRC-CA33-215JAB	342953
C9	Decoupling	10pF ± 5% 500VW	MRC-CA33-310JKO	342947
C10	Tuning	124pF (Part of Coil Assy L3)		
C11	Coupling	470pF ± 2.5% 125VW	MRC-CA41-447BJA	342972
C12	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C13	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C14	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C15	Tuning	102pF (Part of Coil Assy L4)		
C16	Coupling	1.5pF ± .1pF 500VW	MRC-CA33-215JAB	342953
C17	Tuning	127pF (Part of Coil Assy. L5)		
C18	Coupling	330pF ± 2.5% 125VW	MRC-CA41-433BJA	342973
C19	Decoupling	.001uF ± 10% 200VW	MRC-CA33-510JSG	342938

Item	Circuit Function	Description	Other Reference	STC Part No.
R8	Bias	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R9	Bias IC.	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R10	Bias IC.	1KΩ ± CR25	MRC-RS12-310AMK	342921
R11	Bias	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R12	Bias	6.8KΩ ± 5% CR25	MRC-RS12-368AMK	342913
R13	Bias	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R14	Bias	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R15	Bias	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
		TRANSFORMERS		
T1	Coupling	Transformer	MR125-LRA-18A	342063
T2	Coupling	Transformer	MR125-LRA-18B	342064
T3	Coupling	Transformer	MR125-LRA-18C	342065
		TRANSISTORS		
TR1	RF Amplifier	Silicon NPN SS.BP180	MRCST31-036HOA	342991
TR2	Mixer	Silicon F.E.T. TA7153	MRC-ST31-00100A	342990
TR3	Doubler	Silicon NPN 2N918		260215
TR4	Doubler	Silicon NPN 2N3478	MRC-ST31-037FOA	342987
		INTEGRATED CIRCUITS		
IC1	I.F. Amp	CA.3028A	MRC-AFOO-00300A	289015
		DIODES		
D1	Bias	Diode Switch IN4148	MRC-SD33-375AOB	342989
		FILTER ASSEMBLY		
FL1	Filter	Erie Filter-Con.		342862
		FERRITE BEADS		
FB1	RF Decoupling	FX3004 Coretube	MR-LP770121	342882

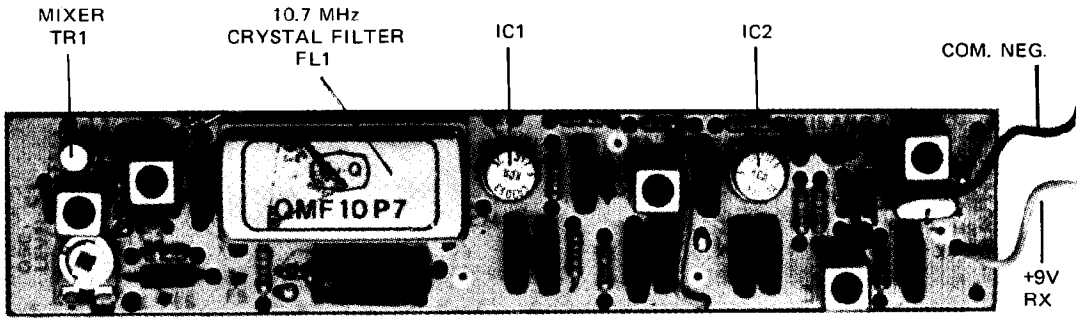
4.7 RECEIVER I.F. BOARD ASSEMBLY

4.7.1 Reference

Diagram No.	Figure 18
Manufacturing Code	28-LRU-792D (342436)
Diagram No.	Figure 19
Manufacturing Code	28-LRU-792A (342080)

The I.F. Board is located as shown by the illustration on page 303.

4.7.2 Brief Description



RECEIVER I.F. AMPLIFIER

This board provides for the generation of the 10.7MHz intermediate frequency, intermediate frequency amplification and demodulation.

The second mixer comprises a junction FET transistor to which is applied the second local oscillator input. For the 400-420MHz band the local oscillator input frequency is in the range 45.63 to 47.85MHz and for the 450-470MHz band the local oscillator input frequency is in the range 35.4 to 37.0MHz. The corresponding first intermediate frequencies are in the range 34.93 to 37.2MHz and 24.7 to 26.3MHz respectively.

The resultant output is applied, via a tuned matching transformer, to filter FL1 comprising a 10.7MHz crystal tuned bandpass circuit. The filter has a passband suitable for either 25 or 50KHz channel spacing, dependent upon specific requirements. The 10.7MHz I.F. is

Circuit Reference	Volts D.C.
IC2 pin 6	5.5
IC2 pin 7	1.0
IC2 pin 9	0.95
R4/R5	8.9
R7/C11	8.5

4.7.5 Testing

CAUTION

No adjustment should be made to the amplifier or discriminator stages unless absolutely necessary and the base screen should be in position while making any such adjustments.

Procedure

i) Disconnect capacitor C7 from crystal filter FL1 and inject 10.7MHz with 15KHz deviation at 1KHz.

ii) Adjust coil L4 for maximum audio output level, bearing in mind that two tuning points occur and the larger output should be selected.

iii) Connect an oscilloscope to the output terminals and adjust coils L4 and L5 for maximum output consistent with a symmetrical waveform.

iv) Adjust tuned transformer T2 for maximum output level and coil L2 for a symmetrical waveform at maximum deviation (5 or 15KHz as specified).

v) Reconnect capacitor C7 to crystal filter FL1.

Note:

Tuned transformer T1 should be adjusted for maximum sensitivity if the board is aligned as part of an overall procedure.

4.7.6 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Coupling	39pF ± 2% 100VW	MRC-CA23-339AKB	342961
C2	Decoupling	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C3	DC Blocking	27pF ± 5% 500VW	MRC-CA33-327JKA	342942
C4	Coupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C5	Bypass	100pF ± 2% 100VW	MRC-CA23-410AKA	342959
C6	Coupling	S.O.T. (See Drawing 342080)		
C7	Coupling	S.O.T. (See Drawing 342080)		
C8	Bypass	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C9	Bypass	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C10	Decoupling	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C11	Decoupling	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C12	Damping	100pF ± 2% 100VW	MRC-CA23-410AKA	342959
C13	Bypass	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C14	Bypass	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C15	Bypass	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C16	Decoupling	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C17	Pad	47pF ± 2% 100VW	MRC-CA23-347AKA	342960
C18	Decoupling	22pF ± 5% 500VW	MRC-CA33-322JKB	342943

Item	Circuit Function	Description	Other Reference	STC Part No.
R9	Decoupling	47Ω ± 5% CR25	MRC-RS12-147AMK	342932
R10	Decoupling	68KΩ ± 5% CR25	MRC-RS12-468AMK	342903
R11	Decoupling	68KΩ ± 5% CR25	MRC-RS12-468AMK	342903
R12	Matching	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R13	Osc.Level	Var. 220Ω ± 20% Morganite 62H	MRC-RS22-222DZA	342886
		TRANSFORMERS		
T1	Tuned Coupling	Prim/Sec. Coils	MRC-CL00-999ZDG	342088
T2	Tuned Coupling	Prim/Sec. Coils	MRC-CL00-999ZDJ	342090
		TRANSISTORS		
TR1	Mixer	F.E. 2N3823	MRC-ST33-002-00	342984
		CRYSTAL FILTER		
FL1	Xtal Filter	10.7MHz Filter	MRU-FC00-0000RQ	342838
		CRYSTAL		
XL1	Discrim.	Crystal 10.7 MHz Hy.Q.	MRU-PE11-0490AA	342882

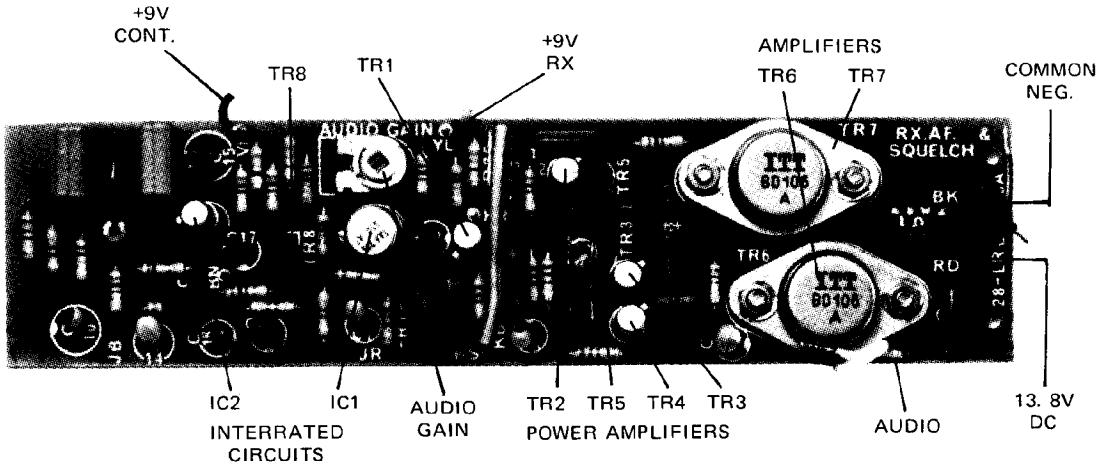
4.8 RECEIVER A.F. & SQUELCH BOARD ASSEMBLY

4.8.1 References

Diagram No.	Figure 20.
Manufacturing Code	28-LRU-793A (342094)

The A.F. & Squelch Board is located as shown by the illustration on page 303.

4.8.2 Brief Description



RECEIVER AF & SQUELCH BOARD

The audio input signal is applied to a d.c. pre-amplifier comprising part of integrated circuit module IC1 and transistor TR1. The pre-amplifier gain is controlled by preset potentiometer R34. Volume control R1 provides adjustment for the input level to the output power amplifier which delivers 2 watts undistorted output.

The squelch circuit comprises a highpass filter which in the absence of an audio signal selects a band of noise. The noise is amplified by integrated circuit module IC2 and rectified by transistor TR8. The squelch signal is applied to the first stage of integrated circuit module IC1 and causes it to conduct, reducing it's collector potential. This in turn, reduces the collector potential of the pre-amplifier, thus cutting off transistor TR1 and removing the audio output. The sensitivity of the squelch circuit is controlled by the squelch potentiometer R2.

4.8.3 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to conduct extensive

RECEIVER A.F. AND SQUELCH BOARD MR28-LRU-793

4.8.5 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Coupling	.47uF +50 -20% Elect. 35VW	MRC-CA52-147KRA	260434
C2	Bypass	.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C3	Bypass	15uF +50 -20% Elect. 16VW	MRC-CA52-315CRA	295214
C4	Bypass	.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C5	Coupling	.47uF +50 -20% Elect. 35VW	MRC-CA52-147KRA	260434
C6	Filter	.1uF ± 10% Poly. 250VW	MRC-CA43-710ANC	342955
C7	Filter	.01uF ± 10% Poly. 400VW	MRC-CA43-610ANA	342956
C8	Bypass	.01uF ± 10% Poly. 400VW	MRC-CA43-610ANA	342956
C9	Output Coupling	100uF +100 -20% Elect. Type T.16VW	MRC-CA50-410DQB	342976
C10	Coupling	.47uF +50 -20% Elect. 35VW	MRC-CA52-147KRA	260434
C11	Filter	.15uF ± 10% Poly.	MRC-CA43-715ANB	283712
C12	Filter	.15uF ± 10% Poly.	MRC-CA43-715ANB	283712
C13	Bypass	.001uF +80 -20% Cer. 500VW	MRC-CA33-510JSG	342938
C14	Bypass	47uF Elect. Tag	MRC-CA52-3470NA	271528
C15	Bypass	15uF +50 -20%	MRC-CA52-315CRA	295214
C16	Bypass	.001uF +80 -20%	MRC-CA33-510JSG	342938
C17	Coupling	.1uF ± 20% Elect. 35VW	MRC-CA52-110KRA	270794
C18	Bypass	.1uF ± 20% Elect. 35VW	MRC-CA52-110KRA	270794
C19	Bypass	15uF +50 -20% Elect. 16VW	MRC-CA52-315CRA	295214

Item	Circuit Function	Description	Other Reference	STC Part No.
R22	Part of Noise Filter	270Ω ± 5% CR25	MRC-RS12-227AMK	342927
R23	Bias	330Ω ± 5% CR25	MRC-RS12-233AMK	342926
R24	Feedback	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R25	Feedback	220KΩ ± 5% CR25	MRC-RS12-522AMK	342900
R26	Decoupling	10KΩ ± 5% CR25	MRC-RS12-410AMK	342911
R27	Feedback	39KΩ ± 5% CR25	MRC-RS12-439AMK	342905
R28	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R29	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R30	Emitter	470Ω ± 5% CR25	MRC-RS12-247AMK	342924
R31	Muting	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R32	Muting Network	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R33	Bias	220Ω ± 5% CR25	MRC-RS12-222AMK	342928
R34	Audio Gain	2.2K Var. ± 20% Morganite 62H	MRC-RS22-322DZA	342884
		TRANSISTORS		
TR1	Pre-Amp	Transistor SS. BC107A	MRC-ST31-021FOA	299722
TR2	Amplifier	Transistor SS. BC107A	MRC-ST31-021FOA	299722
TR3	Amplifier	Transistor SS. BC107A	MRC-ST31-021FOA	299722
TR4	Amplifier	Transistor SS. BC107A	MRC-ST31-021FOA	299722
TR5	Amplifier	Transistor SS. BC212K	MRC-ST32-021FOA	342981
TR6	Power Amplifier	Transistor Power BD106A	MRC-ST31-121BOE	291056
TR7	Power Amplifier	Transistor Power BD106A	MRC-ST31-121BOE	291056
TR8	Noise Rectifier	Transistor SS.BC212K	MRC-ST32-021FOA	342981
		FERRITE BEADS		
FB1	RF Decoupling	Coretube Ferroxcube	FX3004	342882

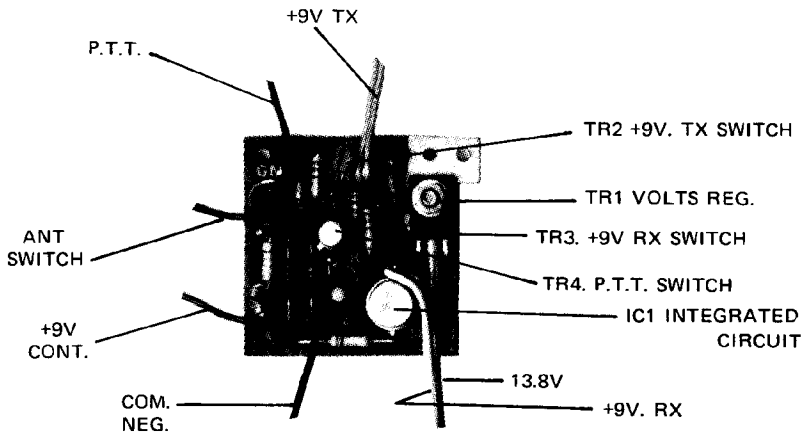
4.9 POWER SUPPLY BOARD ASSEMBLY

4.9.1 Reference

Diagram No.	Figure 21.
Manufacturing Code	14-LRU-471A (342098)

The Power Supply Board is located as shown by the illustration on page 303.

4.9.2 Brief Description



POWER SUPPLY BOARD

The power supply board supplies the transmitter and receiver units with 9V d.c. regulated from the 13.8V d.c. supply of the associated vehicle. The supplies are distributed via the equipment side boards.

The battery supply is first filtered to remove ignition or dynamo pick-up and other unwanted noise. A protection diode ensures that, should the battery polarity be accidentally reversed, the fuse will blow before any damage is sustained by the equipment. The battery filtered output is taken via the ON/OFF switch to the regulator circuit and the 13.8V d.c. is distributed to the boards via the equipment side boards. Module IC1 comprises a voltage regulator and resistor R8 is selected to obtain 9V d.c. output. The 13.8V d.c. supply is applied continuously to the transmitter and receiver circuits. 9V d.c. is applied permanently to the receiver squelch (mute) circuit.

Operation of the transmit or receive circuits is controlled by the presence or absence of the 9V d.c. supply

4.9.5 SCHEDULE OF COMPONENTS

Item	Circuit Function	Description	Other Reference	STC Part No.
		CAPACITORS		
C1	Filtering	.47uF +50 -20% Elect. 35VW	MRC-CA52-147KRA	260434
C2	Filtering	47pF ± 10% Cer. 200VW	MRC-CA33-347EWA	342936
C3	Filtering	1.5uF +50 -20% Elect. 35VW	MRC-CA52-215KRA	270581
		INTEGRATED CIRCUITS		
IC1	Volts Reg.	Integrated Circuit LA300	MRU-RH00-000-000	342978
		RESISTORS		
R1	Bias	1.5Ω ± 5% CR25	MRC-RS12-015AMK	342897
R2	Bias	15KΩ ± 2% MR25	MRC-RS15-415DFA	342889
R3	Bias	2.7KΩ ± 2% MR25	MRC-RS15-327DFA	342891
R4	Bias	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R5	Bias	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R6	Bias	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R7	Bias	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R8	Volts Adjust	S.O.T.		
		TRANSISTORS		
TR1	Volts Reg.	Transistor MJE370	MRC-ST32-122FOB	342980
TR2	Tx Volts	Transistor SS. 2N4402	MRC-ST33-222AOA	342979
TR3	Rx Volts	Transistor SS. 2N4402	MRC-ST33-222AOA	342979
TR4	AE Switch	Transistor SS. BC107A	MRC-ST31-021FOA	299722
		DIODES		
D1	Protection	Situated on Side Board	1N4997R	342999

Item	Circuit Function	Description	Other Reference	STC Part No.
D2	Switching	Diode Sw. IN4148	MRC-SD33-375AOB	342989
D3	Switching	Diode Sw. IN4148	MRC-SD33-375AOB	342989
		FERRITE BEADS		
FB1	Decoupling	Coretube Ferroxcube	FX1242	
FB2	Decoupling	Coretube Ferroxcube	FX1242	

and this, in turn, is controlled by operation of the PTT (press-to-talk) switch on the microphone. The receive condition is to be regarded as the normal state when transistor TR2 is biased off and transistor TR3 conducts, supplying 9V to the receiver circuits. When the PTT switch is depressed an earth is applied to TR2 base, allowing the transistor to conduct, thus supplying 9V to the transmitter circuits. The base potential of TR3 rises and switches the transistor off. The base potential of TR4 then rises and lights the PTT lamp when used whilst operating the aerial control switch on the Transmitter Output Board.

4.9.3 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to conduct tests on the board assembly. When not available alternate types may be used.

i) Multimeter (Avometer Model 8)

ii) 13.8V d.c. power supply

4.9.4 Fault Location

Before attempting to isolate a fault on the Power Supply Board, reference should be made to page 301 of the Manual for information regarding the use of soldering irons and measurement of transistor junction resistances.

The board is designed to operate from a 13.8V d.c. supply and any figures quoted assume the use of such a voltage, and are with respect to the common negative line.

In the absence of an output first check that the battery supply connections are secure and that the fuse is serviceable.

To check the functioning of the board, apply 13.8V d.c. to the battery input terminals and check that the 13.8V and 9V receiver outputs are preset. The aerial switch output should register 13.8V. Connect the PTT point to common negative line and check that the 9V transmitter output is present, whilst the receiver 9V output is removed, but the 13.8V and 9V continuous supplies remain. The aerial switch output should register just slightly positive.

Item	Circuit Function	Description	Other Reference	STC Part No.
FB2	RF Decoupling	Coretube Ferroxcube	FX1242	203742

Item	Circuit Function	Description	Other Reference	STC Part No.
C20	Feedback	4.7uF Solid Tant. 25VW	MRC-CA52-247HRA	260440
		INTEGRATED CIRCUITS		
IC1	Pre.Amp	Lin. Amp TAA293	MCR-AFOO-009-OOB	342983
IC2	Noise Amp	Lin. Amp TAA263	MRC-AFOO-009-00A	342982
		INDUCTORS		
L1	Filter	Inductor 1mH 5810002310 ± 10%	MRC-CLOO-410-OOA	342876
		RESISTORS		
R1	Matching	6.8KΩ ± 5% CR25	MRC-RS12-368AMK	342913
R2	Matching	6.8KΩ ± 5% CR25	MRC-RS12-368AMK	342913
R3	Bias	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R4	Bias	820Ω ± 5% CR25	MRC-RS12-282AMK	342922
R5	Bias	470Ω ± 5% CR25	MRC-RS12-247AMK	342924
R6	Emitter	22Ω ± 5% CR25	MRC-RS12-122AMK	342933
R7	Feedback	10KΩ ± 5% CR25	MRC-RS12-410AMK	342911
R8	Feedback	15KΩ ± 5% CR25	MRC-RS12-415AMK	342910
R9	Part of Gain Cont.	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R10	De-emphasis	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R11	De-emphasis	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R12	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R13	Bias	680Ω ± 2% MR25	MRC-RS15-268DFA	342894
R14	Feedback	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R15	Bias	2KΩ ± 2% MR25	MRC-RS15-3200FA	342892
R16	Bias	1KΩ ± 2% MR25	MRC-RS15-310AMK	342893
R17	Emitter	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R18	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R19	Feedback	1Ω ± 10% IRC W/Wound	4V3J	342857
R20	Feedback	6.2KΩ ± 2% MR25	MRC-RS15-362DGA	342890
R21	Matching	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916

tests on the board assembly. When the test equipment specified is not available equivalent types may be used.

i) Multimeter (Avometer Model 8)

ii) Audio signal generator (Advance type J2)

iii) Oscilloscope (Tektronix type 515AO)

iv) R.F. valve voltmeter (Boonton type 91DA)

v) D.C. supplies for 9V and 13.8 volts.

4.8.4 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the A.F. and Squelch Board reference should be made to page 301 for information regarding the use of soldering irons and measurements of transistor junction resistances.

If there is no output or it is low or distorted, check that the d.c. supply voltages are correct. The 9V d.c. current drawn should be approximately 20mA and the 13.8V d.c. current should be less than 10mA.

The table below indicates d.c. voltages, measured with respect to earth using a multimeter.

Transistor (TR)	Emitter	Base	Collector
1	0.2	0.84	5.0*
2	0	0.64	6.5
3	6.5	7.15	6.5
4	7.75	8.35	13.8
5	7.15	6.5	0.6
6	7.2*	7.8	13.8
7	0	0.6	7.2*
8	9.0	9.0	0 *

Readings marked thus * are particularly meaningful and if incorrect indicate a fault. If transistor TR8 collector does not indicate zero volts, the noise amplifier is probably oscillating and should be checked for a faulty component.

To check the audio pre-amplifier and amplifier stages, strap the squelch filter input connections, connect at 1KHz audio signal generator to the AUDIO INPUT and adjust the oscillator level to 100mV peak to peak. The output at the speaker terminals should measure 7 to 8 volts peak to peak.

Item	Circuit Function	Description	Other Reference	STC Part No.
C19	Decoupling	22pF ± 5% 500VW	MRC-CA33-322JKB	342943
C20	Bypass	3.3pF ± .5pF 500VW	MRC-CA33-233JCC	342952
C21	Decoupling	0.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C22	Coupling	3.3pF ± .5pF 500VW	MRC-CA33-233JCC	342952
C23	Pad	27pF ± 5% 500VW	MRC-CA33-327JKA	342942
C24	Bypass	S.O.T. (See Drawing 342080)		
C25	Decoupling	100uF + 100 -20% Elect. 16VW	MRC-CA50-410DQB	342976
		INTEGRATED CIRCUITS		
IC1	IF Amplifier	Integrated Circuit CA3053	MRC-AF00-00300G	342988
IC2	Amp/Limit/ Discrim.	Integrated Circuit CA3014	MRC-AF00-00300D	342985
		INDUCTORS		
L1	Filter	Inductor Coil 15uH 5810001210	MRC-CL00-21500B	342879
L2	Tuned Load	Inductor Coil	MRC-CL00-999ZDH	342089
L3	Not used			
L4	Tuned Load	Inductor Coil	MRC-CL00-999ZDK	342091
L5	Tuned Load	Inductor Coil	MRC-CL00-999ZDL	342092
		RESISTORS		
R1	Bias	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R2	Bias	390Ω ± 5% CR25	MRC-RS12-239AMK	342925
R3	Bias	18KΩ ± 5% CR25	MRC-RS12-418AMK	342909
R4	Decoupling	47Ω ± 5% CR25	MRC-RS12-147AMK	342932
R5	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R6	Bias	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R7	Decoupling	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R8	Decoupling	100Ω ± 5% CR25	MRC-RS12-210AMK	342930

amplifier by integrated circuit module IC1, and transformer coupled by T2 to IC2. Integrated circuit module IC2 serves the combined function of I.F. amplifier limiter, F.M. detector and audio pre-amplifier. The 10.7MHz tuned circuit for the discriminator consists of crystal XL1 and pulling circuit L5 and L3. The board output is a low level A.F. signal.

1st I.F. input = 34.93-37.2MHz or 24.7-26.3MHz
2nd mixer input = 45.63-47.85MHz or 35.4-37.0MHz
2nd I.F. = 10.7MHz
Channel spacing = 25 or 50KHz according to filter (FL1)

4.7.3 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to conduct extensive tests on the board assembly. When the test equipment specified is not available equivalent types may be used.

i) Multimeter (Avometer Model 8)

ii) F.M. signal generator (Marconi TF.1066B/1).

iii) Oscilloscope (Tektronix type 515A).

4.7.4 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the I.F. Board, reference should be made to page 301 of this Manual for information regarding the use of soldering irons and measurement of transistor junction resistances.

The board is extremely sensitive to external pick-up etc., and as such R.F. tests are difficult. The table below indicates typical d.c. voltages measured, using a multimeter, with respect to earth. The total +9V d.c. current drawn should be approximately 35mA.

Circuit Reference	Volts D.C.
IC1 pin 2	3
IC1 pin 4	2.1
IC1 pin 5	6
IC2 pin 1	2.1
IC2 pin 3	2.1
IC2 pin 4	2.1
IC2 pin 5	8.9
IC2 pin 10	8.2

Item	Circuit Function	Description	Other Reference	STC Part No.
FB2	RF Decoupling	FX3004 Coretube Ferroxcube	MR-LP779121	342882
FB3	RF Decoupling	FX1483 Coretube Ferroxcube	MR-LP737001	342883
FB4	RF Decoupling	FX1483 Coretube Ferroxcube	MR-LP737001	342883
FB5	RF Decoupling	FX1483 Coretube Ferroxcube	MR-LP737001	342883

Item	Circuit Function	Description	Other Reference	STC Part No.
C20	Decoupling	.001uF ± 10% 200VW	MRC-CA33-510JSG	342938
C21	Tuning	Var: 2-8pF DV11 PS8A JFD	MRC-CV31-060AOC	342953
C22	Coupling	32pF ± 5% 200VW	MRC-CA33-333EKA	342940
C23	Tuning	Var: 2-8pF DV11 PS8A JFD	MRC-CV31-060AOC	342953
C24	Not used			
C25	Not used			
C26	Filter	.001uF ± 10% 200VW	MRC-CA33-510JSG	342938
C27	Bypass	1.5pF ± .1pF 500VW	MRC-CA33-215JAB	342953
C28	Decoupling	.001uF ± 10% 200VW	MRC-CA33-510JSG	342938
		INDUCTORS		
L1	Load	Inductor .22uH	58-10-001-10	263791
L2	Tuned Mixer Load	Coil Assy. c/w Cap. C5 Slug Tuned	MRC-CL00-999ZDP	342066
L3	Tuned I.F. Amplifier	Coil Assy. Slug Tuned c/w Cap. C10	MRC-CL00-999ZDS	342067
L4	Tuned ICI Load	Coil Assy. Slug c/w Cap. C15	MRC-CL00-999ZDS	342068
L5	Tuned Output Load to Rx IF	Coil Assy. Slug Tuned c/w Cap. C17	MRC-CL00-999ZDT	342069
		RESISTORS		
R1	Emitter	330Ω ± 5% CR25	MRC-RS12-233AMK	342926
R2	Decoupling	100Ω ± 5% CR25	MRC-RS12-210AMK	342930
R3	Bias	8.2KΩ ± 5% CR25	MRC-RS12-382AMK	342912
R4	Bias	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R5	Bias	15KΩ ± 5% MR25	MRC-RS12-415DFA	342910
R6	Bias	560Ω ± 2% MR25	MRC-RS15-256DFA	342895
R7	Emitter	150Ω ± 5% CR25	MRC-RS12-215AMK	342929

TR4 are connected in two frequency doubler circuits, providing the first mixer input within the required frequency range.

R.F. input frequency	=	450-470MHz	400-420MHz
Mixer input frequency	=	424.8-444MHz	365.07-382.8MHz
Oscillator input freq.	=	106.2-111MHz	91.26-95.70MHz
I.F. range	=	24.7-26.3MHz	34.93-37.2MHz
I.F. gain	=	30db	30db

4.6.3 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to conduct extensive tests on the board assembly. When the test equipment specified is not available equivalent types may be used.

i) Multimeter (Avometer Model 8).

ii) Sensitive R.F. voltmeter (Boonton 91DA).

iii) Signal generator (Marconi TF .801/D).

iv) DC power supply 9V limited at 50mA.

4.6.4 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the R.F. Board reference should be made to page 301 for information regarding the use of soldering irons and measurement of transistor junction resistances.

The field-effect transistor TR2 is a delicate and sensitive device, extreme care should be exercised particularly during replacement.

The table below indicates the nominal d.c. voltages that can be expected under quiescent conditions. Voltages are measured with respect to the common negative line, using a multirange meter. The total current drawn should be approximately 20 mA.

Test Point	Voltage
TR1 emitter	0.6
TR1 base	1.3
TR1 collector	8.6
TR2 pin 2	1.35
TR2 pin 4	0.7
TR4 base	0.9

specified is not available equivalent types may be used.

(1) Multimeter (Avometer Model 8)

(2) Sensitive r.f. voltmeter (Boonton 91DA)

(3) 9V d.c. limited at 50mA power supply

4.5.4 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the Receiver Multiplier Board reference should be made to Section 3.2 Page 301 for information regarding the use of soldering irons and measurement of transistor junction resistances.

If the Receiver Multiplier Board is faulty check that the 9V supply is available. The current drawn should be approximately 10mA when driven from the receiver oscillator board 16-LMU-7B at an input level of approximately 0.9V r.m.s.

The table below indicates the d.c. voltages with respect to the common negative as measured with a multimeter (Avometer Model 8).

Test Point	Volts D.C.
TR1 emitter	0
TR1 base	0.6
TR1 collector	8.0

With the output terminations D and DS terminated in a 1KΩ load and T1 and L2 adjusted for maximum output the r.f. voltmeter when connected across the 1000Ω resistor should indicate a value in excess of 1.0 r.m.s.

If the measurements made are very different from those above check that the input from the oscillator board is correct and that the transformer T1 and the inductors L1 and L2 have continuity.

If the above checks do not enable isolation of a fault, a detailed check of each component should be carried out.

Item	Circuit Function	Description	Other Reference	STC Part No.
R302	Bias	4.7KΩ ± 5% Carb. Film	MRC-RS12-347AMK	342916
R303	Damping	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R304	Decoupling	47Ω ± 5% Carb. Film	MRC-RS12-147AMK	342932
R305	Isolating	1.5KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R401	Bias	4.7KΩ ± 5% Carb. Film	MRC-RS12-347AMK	342916
R402	Bias	4.7KΩ ± 5% Carb. Film	MRC-RS12-347AMK	342916
R403	Damping	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R404	Decoupling	47Ω ± 5% Carb. Film	MRC-RS12-147AMK	342932
R405	Isolating	1.5KΩ ± 5% Carb. Film	MRC-RS12-315AMK	342919
		TRANSFORMERS		
T1	Output Transformer	Inductor Coil AAE		342114
T201	Feedback	Inductor Coil ADX		342118
T301	Feedback	Inductor Coil ADX		342118
T401	Feedback	Inductor Coil ADX		342118
		TRANSISTORS		
TR1	Amplifier	Transistor Silicon	2N918	260215
TR2	Oscillator	Transistor Silicon	2N918	260215
TR3	Oscillator	Transistor Silicon	2N918	260215
TR4	Oscillator	Transistor Silicon	2N918	260215

Item	Circuit Function	Description	Other Reference	STC Part No.
R21	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342902
R22	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R23	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R31	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R32	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R33	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R41	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R42	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R43	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R51	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R52	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R53	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R61	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R62	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R63	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R71	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902
R72	Isolating	330Ω ± 5% Carb. Film	MRC-RS12-233AMK	342926
R73	Xtal Bypass	1KΩ ± 5% Carb. Film	MRC-RS12-310AMK	342921
R81	Diode Bias	100KΩ ± 5% Carb. Film	MRC-RS12-510AMK	342902

Item	Circuit Function	Description	Other Reference	STC Part No.
C12	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C21	Trimmer	2-22pF Variable	2222.808.00006	342852
C22	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C31	Trimmer	2-22pF Variable	2222.808.00006	342852
C32	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C41	Trimmer	2-22pF Variable	2222.808.00006	342852
C42	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C51	Trimmer	2-22pF Variable	2222.808.00006	342852
C52	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C61	Trimmer	2-22pF Variable	2222.808.00006	342852
C62	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C71	Trimmer	2-22pF Variable	2222.808.00006	342852
C72	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C81	Trimmer	2-22pF Variable	2222.808.00006	342852
C82	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C91	Trimmer	2-22pF Variable	2222.808.00006	342852
C92	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C101	Trimmer	2-22pF Variable	2222.808.00006	342852
C102	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C111	Trimmer	2-22pF Variable	2222.808.00006	342852
C112	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C121	Trimmer	2-22pF Variable	2222.808.00006	342852
C122	Bypass	.01uF +80 -20%	MRC-CA33-610FSA	342937
C201	Bypass	.01uF +80 -20%	MRC-CA33-610FSA	342937
C202	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937

Item	Circuit Function	Description	Other Reference	STC Part No.
C18	Pad	9pF ± .5pF 500VW	MRC-CA33-290JCA	342948
C19	Coupling	32pF ± 5% 500VW	MRC-CA33-332JKA	342941
		INDUCTORS		
L1	Tuning	Coil Assy. Slug Tuned	MRC-CL00-999ZDA	342106
L2	Tuning	Coil Assy. Slug Tuned	MRC-CL00-999ZDB	342107
L3	Tuning	Coil Assy. Slug Tuned	MRC-CL00-999ZDC	342108
L4	Tuning	Coil Assy. Slug Tuned	MRC-CL00-999ZDD	342109
L5	Tuning	Coil Assy. Slug Tuned	MRC-CL00-999ZDE	342110
		RESISTORS		
R1	Bias	4.7KΩ ± 5% CR25	MRC-RS12-374AMK	342916
R2	Bias	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R3	Emitter	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R4	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R5	Bias	470Ω ± 5% CR25	MRC-RS12-247AMK	342924
R6	Emitter	470Ω ± 5% CR25	MRC-RS12-247AMK	342924
R7	Bias	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R8	Bias	4.7KΩ ± 5% CR25	MRC-RS12-347AMK	342916
R9	Emitter	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R10	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R11	Bias	470Ω ± 5% CR25	MRC-RS12-247AMK	342924
R12	Emitter	220Ω ± 5% CR25	MRC-RS12-222AMK	342928
R13	Bias	6.8KΩ ± 5% CR25	MRC-RS12-368AMK	342913
R14	Bias	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R15	Bias	100Ω ± 5% CR25	MRC-RS12-210AMK	342930

this amplifier provides, directly the input to the receiver second mixer and via the frequency multiplier stage, consisting of TR5 and the associated bandpass coupling circuit, the input to the local oscillator multiplier chain on the receiver RF amplifier board.

The crystal frequencies are allocated in the range 35.438460 to 36.976920MHz for the band 450-470MHz and may be calculated from the following expression.

$$\text{Crystal frequency} = \frac{\text{Receiver operating frequency } +10.7\text{MHz}}{13}$$

For the band 400-420MHz crystal frequencies are in the range 45.633333 to 47.855555MHz and the expression for crystal frequencies is:-

$$\text{Crystal frequency} = \frac{\text{Receiver operating frequency } +10.7\text{MHz}}{9}$$

4.4.15 Recommended Test Equipment (Multi-channel)

The recommended test equipment is as listed for the single channel transmitter/receiver oscillator board.

4.4.16 Fault Location/Testing

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the transmitter or receiver oscillator boards reference should be made to page 301 for information regarding the use of soldering irons and the measurement of transistor junction resistances.

If an oscillator section is faulty check the 9V d.c. supply.

With the output terminations (TX and S or TX and S) of the oscillator board disconnected from the equipment coaxial cables and terminated in 50Ω connect a valve voltmeter across the respective terminations.

The reading obtained should be approximately 0.25V.

The table below indicates the d.c. voltage with respect to the common negative using a multi meter (avometer model 8).

	Volts D.C.	
Test Point	16-LMU-8C	16-LMU-8E
TR1 emitter	1.3	1.3
TR1 base	2.1	2.1
TR1 collector	9	9

4.4.13 Brief Description (4 Channels)

In a multi channel MTR10-191 series radiotelephone for four channels the transmitter and receiver are supplied from a single board which mounts the two crystal oscillator groups and their associated circuitry.

This board uses the same method of channel switching as that used for the eight and twelve channel units and consequently embrace the same circuitry with the addition of the receiver oscillator multiplier unit.

References

Title	Transmitter/Receiver Oscillator Board
Diagram No.	
Manufacturing Code	16-LMU-8C 4 channel 342189 (400-420 MHz)
	16-LMU-8E 4 channel 342191 (450-470 MHz)

4.4.14 Detailed Description

Photographic description of this Model not available at the time of going to press

The operation of the receiver oscillator board is similar to that of the transmitter oscillator board. The output of this board provides the local oscillator input to the second mixer and the input to the multiplier 270-LMU-4.

The crystal frequencies are allocated in the range 35.438460 to 36.976920MHz for the band 450-470MHz and may be calculated from the following expression.

$$\text{Crystal frequency} = \frac{\text{Receiver operating frequency} + 10.7\text{MHz}}{13}$$

For the band 400-420MHz crystal frequencies are in the range 45.633333 to 47.855555MHz and the expression for crystal frequencies is:-

$$\text{Crystal frequency} = \frac{\text{Receiver operating frequency} + 10.7\text{MHz}}{9}$$

4.4.11 Recommended Test Equipment (Multi-channel)

The recommended test equipment is as listed for the single channel transmitter/receiver oscillator board.

4.4.12 Fault Location/Testing

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the transmitter or receiver oscillator boards reference should be made to page 301 for information regarding the use of soldering irons and the measurement of transistor junction resistances.

If a oscillator section is faulty check the 9V d.c. supply.

With the output terminations of the oscillator board disconnected from the equipment coaxial cables and terminated in 50Ω connect a valve voltmeter across these terminations O/P and S.

The reading obtained should be approximately 0.25V.

The table below indicates the d.c. voltage with respect to the common negative using a multi meter (avometer model 8).

defective buffer multiplier or switch. If an output is obtained on some positions only this indicates a fault in the appropriate oscillator stage.

4.4.9 Brief Description (8 and 12 Channels)

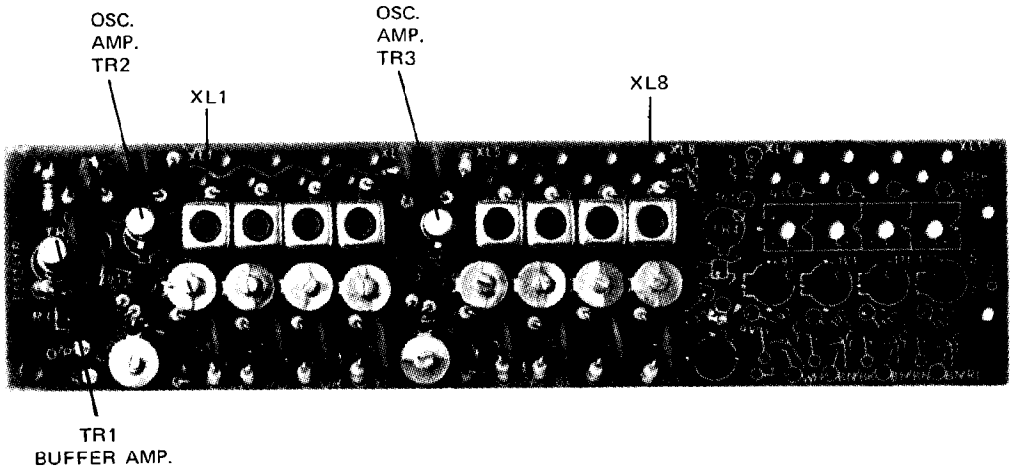
In a multi channel MTR10-191 series radiotelephone for eight and twelve channels the transmitter and receiver are supplied from separate boards which mount the crystal oscillators.

These boards use a different method of channel switching than used for the three and five channel units and consequently embrace different circuitry.

References

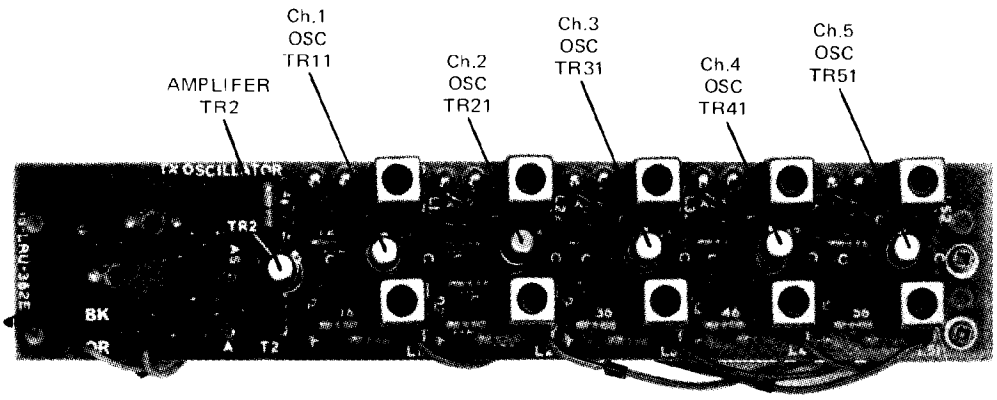
Title	Transmitter Oscillator Board
Diagram No.	Figure 28
Manufacturing Code	16-LMU-7E 8 channel 342129 16-LMU-7A 12 channel 342126
Title	Receiver Oscillator Board
Manufacturing Code	16-LMU-7F 8 channel 342130 16-LMU-7B 12 channel 342127

4.4.10 Detailed Description



8 CHANNEL OSCILLATOR BOARD
16 LMU-7

4.4.7 Description (3 and 5 Channels)



5 CHANNEL OSC: TRANSMITTER 45—470 MHz

The transmitter oscillator board mounts three or five oscillator circuits, enabling selection of one of any of the frequencies concerned. Selection of a particular oscillator is achieved by switching 9 volts d.c. to the appropriate circuit. Channel one oscillator contains crystal XL1 and pulling coil L12. Coil L11 is tuned to the requested output frequency. Resistor R5, diode D11, resistor R11 and inductor L11 form a potential divider chain for the base of transistor amplifier buffer stage TR2 by applying 9 volts d.c. to the channel one connection when this is selected. Thus diode D11 is forwarded biased and diodes D21, D31 etc. are back-biased in order to isolate the remaining channel oscillators.

The output to the transmitter multiplier board is via the tuned transformer T2.

The crystal frequencies are allocated in the range 25.000000 to 26.111111MHz for the 450-470MHz band and in the range 22.222222 to 23.333333 for the band 400-420MHz and may be calculated from the following expression.

$$\text{Crystal frequency} = \frac{\text{Transmitter output frequency}}{18} \text{ MHz}$$

Test Point	Volts D.C.
TR1 emitter	4.0
TR1 base	4.5
TR1 collector	9.0
TR2 emitter	2.5
TR2 base	3.0
TR2 collector	9.0

If the measurements made are not very different from those above, adjust coil L1 over it's complete range and check for an indication on the valve voltmeter. If an output is obtained tune coil L1 for maximum indication and then turn the core one more turn counter clockwise. Connect a frequency counter to the output and adjust coil L2 for the correct frequency. If no output is obtained check the coils and transformers for continuity. If the above checks do not enable isolation of a fault, a detailed check of each component should be carried out.

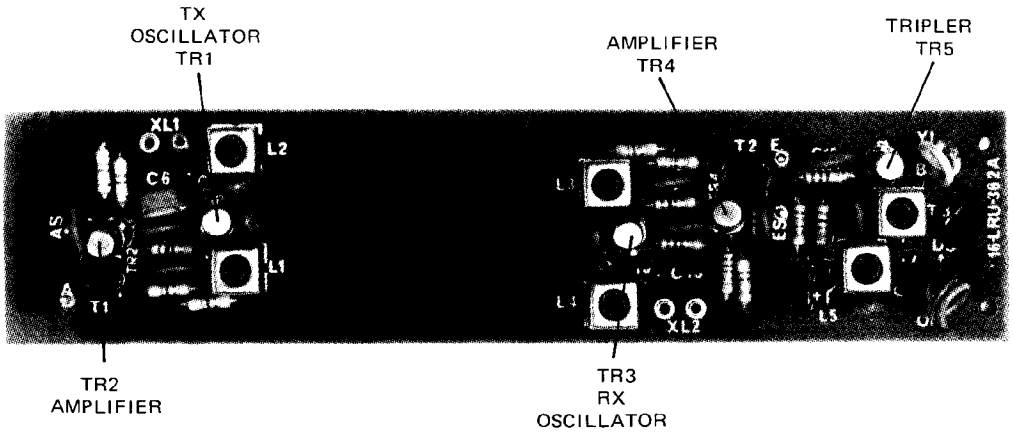
If the Receiver Oscillator is faulty on a combined Transmitter/Receiver Oscillator Board, check the 9V d.c. supply. The total current drawn should be approximately 32mA. Connect a valve voltmeter to points E & Es. The reading obtained should be approximately 0.6V into 50Ω. The voltage across the secondary of transformer T2 should be approximately 0.5V.

The table below indicates d.c. voltages with respect to earth, using a multimeter (Avometer Model 8).

Test Point	Volts D.C.
TR3 emitter	4.0
TR3 base	4.5
TR3 collector	9.0
TR4 emitter	2.5
TR4 base	3.0
TR4 collector	9.0
TR5 emitter	0
TR5 base	0.6
TR5 collector	8.0
R13/D1 junction	0.6

If the measurements made are not very different from those above, adjust coil L3 over it's complete range and

4.4.3 Detailed Description



TRANSMITTER/RECEIVER OSCILLATOR BOARD.

The high stability crystal oscillator circuit used for both transmitter and receiver oscillators employs a transistor in a grounded base circuit. The collector circuit is tuned to the crystal frequency ensuring oscillations in the correct harmonic mode. Feedback from collector to emitter uses a capacity tap. A series tuned circuit permits the crystal to be pulled to the correct frequency. A small capacitor and Ferrite bead in the emitter/base circuit prevents high frequency parasitic oscillations.

The transmitter oscillator includes crystal XL1, in the frequency range 22.222222 to 23.333333MHz and 25.000000 to 26.111111MHz, and pulling-coil L2. Coil L1 is tuned to the required output frequency. The C.W. signal is transformer-coupled to the Transmitter Multiplier Board via transistor amplifier buffer stage TR2.

Crystal XL1 is supplied according to frequency allocation and may be calculated from the following expression:-

$$\text{Crystal frequency} = \frac{\text{Transmitter output freq.}}{18} \text{ MHz}$$

(400-420MHz and
450-470MHz bands)

The receiver oscillator includes crystal XL2, in the frequency range 45.633333 to 47.855555MHz at 35.438460 to 36.976920MHz, and pulling-coil L4. Coil L3 is

Item	Circuit Function	Description	Other Reference	STC Part No.
L2	R.F. Choke	.22uH Inductor 5810000110	MRC-CL00-02200D	342880
L3	R.F. Choke	.22uH Inductor 5810000110	MRC-CL00-02200D	342880
L4	R.F. Choke	.22uH Inductor 5810000110	MRC-CL00-02200D	342880
		RESISTORS		
R1	Bias	270Ω ± 5% CR25	MRC-RS12-227AMK	342927
R2	Bias	220Ω ± 5% CR25	MRC-RS12-222AMK	342928
R3	Voltage - Level - Adj.	1KΩ Pot. ±20% Morganite 62H	MRC-RS22-310DZA	342822
R4	Temp: Sens:	Thermistor YC0.80TB	MRC-RS71-118ABA	342829
R5	Emitter	0.33Ω ± 10% 2.5W	MRC-RS11-003EMW	342821
R6	Bias	330Ω ± 5% CR25	MRC-RS12-233AMK	342926
R7	Bias	10KΩ ± 5% CR25	MRC-RS12-410AMK	342911
R8	Bias	330Ω ± 5% CR25	MRC-RS12-233AMK	342926
R9	Matching	470Ω ± 5% CR25	MRC-RS12-247AMK	342924
R10	Matching	5.6Ω ± 2% ½W	RS-602-01B	292450
R11	Matching	220Ω ± 5% ½W	MRC-RS12-222AMK	342928
		TRANSISTORS		
TR1	Driver	Transistor MJE370	MRC-ST32-122FOB	342980
TR2	Antenna Switch	Transistor ZTX502	MRC-ST32-031FOE	342820
		AMPLIFIER MODULE 10W		
MX. 12-G	Amplifier	M/Rola Amp (TFC1)	MHW-710/2	342830
		DIODE		
D1	Volt:Reg:	Diode BZY88-C8V2	MRC-SD23-182ABA	342818
D2	Switch	Diode IN4148	MRC-SD33-375AOB	342989
D3	Switch	Diode IN4148	MRC-SD33-375AOB	342989

vi) Connect the RF voltmeter with 50 ohm adaptor across the RX cable termination.

vii) Increase the signal generator output level to 150mW, as indicated on the thru-line wattmeter, and check that the R.F. output measures approximately 10 watts.

viii) Check that the R.F. voltmeter reading does not exceed 500mV.

ix) Swing the signal generator over the frequency range 400-420MHz or 450-470MHz as required and check that the R.F. output does not fall below 10 watts.

B. Control Circuit

i) With the amplifier assembly connected as per paragraph vii) in test A a contact thermometer is used to measure the temperature of the heat sink of the RF module adjacent to the RF output terminals.

ii) With the drive control potentiometer R3 set at maximum resistance value, permit the amplifier to operate continuously until the heatsink temperature reaches an operating temperature of 80°C.

iii) Adjust R3 to the resistance value which decreases the output power by approximately 0.5 watt. The drive control circuit is now correctly operative and will automatically control the drive and heatsink temperature.

C. Aerial Switching Circuit

i) The test outlined in paragraphs i), ii), iii), iv) and vii) of Section A above provide a satisfactory check of the transmitter switching diode.

ii) To check the receiver switching diode and auxiliary circuit remove all test equipment detailed in test A excluding the RF voltmeter and 50 Ω adaptor across the receiver cable termination.

iii) Connect the 13.8V d.c. supply to the amplifier assembly. Note that the transmitter drive is removed for this test. The switch is now biassed to the receive condition.

Before attempting to isolate a fault on the Output Board, reference should be made to page 301 of this manual for information regarding the use of soldering irons and measurements of transistor junction resistances.

Generally, most fault finding on the Power Amplifier Assembly can be carried out using a multimeter and a U.H.F. input signal source operating within the frequency ranges specified. It is important that the antenna socket has a suitable load fitted whilst the Board is operating under drive conditions.

In the quiescent condition the final oscillator inputs of TFC1 should measure approximately 13.8V d.c. The current drain on the 13.8V d.c. supply should be 0.25A-no output (crystal out), 3.1A-at 10.5W RF outputs and the 9V d.c. drain about 27.5mA.

If when the drive input is applied to the module no output power is obtained, check that the collector potentials are available to the controlled and final stages of the module and that the transmit switching diode is energised by the PTT function which establishes 9V on the TX function lead. The switching current required by the diode D5 circuit is approximately 30mA. Note that long duration test procedures will cause the thermistor R4 to provide control on the base circuit of TR1 causing a reduction in the collector voltage of the driver stage of the module. Resistor R3 is adjusted to permit control to commence when the module base temperature reaches 80°C.

Should the above information not enable rapid location of a fault, the procedure detailed under TESTING should be carefully followed and any suspect results investigated.

The power amplifier module (TFC1) is designed to accept an input from the Multiplier Board at a level of approximately 120mW and to boost the R.F. power to a nominal 10 watts, measured at the output port i.e. the aerial switch and low pass filter insertion losses are included.

The amplifier is a modular device with a nominal power rating of 13 watts at 12.5 volts. It is a three stage amplifier with provision for control of the drive to the output stages by means of the control of the collector supply potential to the first amplifier stage.

The control to the first stage is accomplished by means of transistor TR1 connected with it's collector emitter circuit in the driver stage collector, so that changes in the supply voltage cause changes in the voltage drop across resistance R5, and consequently, changes in the emitter-base potential of TR1 which cause some degree of compensation by providing a change in the drive conditions of the first stage of the module amplifier. The main function, however, of the control transistor TR1 is to prevent excessive temperature rise of the module when fault conditions cause the mobile to be operated in a continuous mode. In these circumstances the temperature sensing device R4 provides a large rate of change of it's nominal resistance value, at temperatures in the proximity of 80^{o}C and consequently there is a decrease in the supply potential to the driver stage of the transmitter module and a reduction in the power output of module.

If the transmitter is maintained in the transmit condition continuously then dependent on the ambient temperature, a level of power output will be established which, due to device power dissipation will maintain the amplifier module heat sink at a temperature a little in excess of 80^{o}C.

The output of the amplifier module is connected to the aerial via the solid state transmit-receive switch D5, D6 and the low pass filter X1, X2, X3, X4, X5, C7, C8, C9, C10 and the isolating capacitors C1 and C11.

The transistor TR2 controls the switching current for the diodes D5, D6 of the transmit-receive switch. When the press-to-talk (transmit) function is initiated, D3 conducts and the bias developed across R7 causes the transistor TR2 to become non conducting and thus D6 the receiver switching diode becomes non conducting. The transmit function due to the 9 volt supply potential established, also causes D5 to conduct via R6 the current limiting resistor, and the radio frequency decoupling

Item	Circuit Function	Description	Other Reference	STC Part No.

Note:

MULTIPLIER BOARD 270-LRU-3C

The 270-LMU-3A schedule of components holds good for the Model 270-LRU-3C, except for the following alternative components.

C22	Trimmer	4-20pF Variable	MRC-CV31-116AOA	342522
C23	Trimmer	4-20pF Variable	MRC-CV31-116AOA	342522

Item	Circuit Function	Description	Other Reference	STC Part No.
R12	Decoupling	47 ohm ± 5% CR25	MRC-RS12-147AMK	342932
R13	Bias	3.3K ohm ± 5% CR25	MRC-RS12-333AMK	342917
R14	Bias	1K ohm ± 5% CR25	MRC-RS12-310AMK	342921
R15	Decoupling	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R16	Load	1K ohm ± 5% CR25	MRC-RS12-310AMK	342921
R17	Bias	4.7K ohm ± 5% CR25	MRC-RS12-347AMK	342916
R18	Bias	1K ohm ± 5% CR25	MRC-RS12-310AMK	342921
R19	Decoupling	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R20	Emitter	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R21	Bias	68 ohm ± 5% CR25	MRC-RS12-168AMK	342931
R22	Decoupling	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R23	Emitter	33 ohm ± 5% CR25	MRC-RS12-133AMK	342896
R24	Bias	47 ohm ± 5% CR25	MRC-RS12-147AMK	342932
R25	Not Used			
R26	Decoupling	10 ohm ± 5% CR25	MRC-RS12-110AMK	342934
R27	Load	100K ohm ± 5% CR25	MRC-RS12-510AMK	342902
R28	RF Stopper	100 ohm ± 5% CR25	MRC-RS12-210AMK	342930
R29	Decoupling	470 ohm ± 5% CR25	MRC-RS12-247AMK	342924
R30	Matching	10 ohm ± 5% CR25	MRC-RS12-110AMK	342934
R31	Decoupling	10 ohm ± 5% CR25	MRC-RS12-110AMK	342934

Item	Circuit Function	Description	Other Reference	STC Part No.
C18	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C19	Pad	10pF ± .25pF 63VW	MRC-CA33-3100BA	342964
C20	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C21	Bypass	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C22	Trimmer	3-10pF -10 +50%	MRC-CV31-070AOB	342835
C23	Trimmer	3-10pF -10 +50%	MRC-CV31-070AOB	342835
C24	Trimmer	3-10pF -10 +50%	MRC-CV31-070AOB	342835
C25	Coupling	2.2pF ± 25pF 63VW	MRC-CA33-2220BA	342966
C26	Coupling	27pF ± 2% 63VW	MRC-CA33-3270BA	342962
C27	Coupling	27pF ± 2% 63VW	MRC-CA33-3270BA	342962
C28	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C29	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C30	Decoupling	.1uF ± 10% 250VW	MRC-CA43-710ANC	342955
C31	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C32	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C33	Trimmer	10-40pF		342836
C34	Decoupling	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C35	Bypass	.01uF +80 -20% 250VW	MRC-CA33-610FSA	342937
C36	Decoupling	4.7uF Electrolytic 25VW	TAG	260440
		INDUCTORS		
L1	Filter	47uF 5810001510	MRC-CL00-24700A	342877
L2	Part of Tuned Doubler	Coil	MRC-270-LMU-3D3	342034

ii) Check that the audio input level at 1KHz does not exceed 70mV to obtain a deviation indication of 5KHz.

iii) Check that the audio input level at 1KHz does not exceed 150mV to obtain a deviation indication of 15KHz.

(D) Testing Filter for Passband Attenuation

i) Using the Polyskop, check that the insertion loss of the filter over the passband is within the range 1 to 1.25db.

ii) Check that the -3db points are at approximately 393 and 427 (for 400-420MHz band) and 443 and 477MHz for the (450-470MHz band).

If the board output level is low, check the voltage across resistor R31, if this is of the order of 0.8V d.c. the fault is within the varactor tripler circuit and may be due to a faulty diode or possibly incorrect alignment.

If the voltage across resistor R31 is appreciably less than 0.8V d.c. check the voltages across resistors R22 and R15. Both measurements should be between 2 and 3 volts. If correct, then the fault lies either within the coupling circuits or the transistors are defective.

If the voltages across resistor R15 is low and transistor TR3 is working correctly, check the d.c. voltage at the junction of R13/D2. This should measure 0.6V d.c. and if incorrect indicates that diode D2 or resistor R13 is faulty.

If the bias measurement is correct, check the carrier level at the emitters of transistors TR1 and TR2. Absence of drive, as shown by the valve voltmeter, indicates a faulty transistor or defective component in the associated coupling circuit.

The table below indicates transistor d.c. voltages, measured with respect to earth, using the multimeter. The carrier source signal should be connected.

Transistor (TR)	Emitter	Base	Collector
1	0.55	1.2	7.3
2	1.0	2.1	7.8
3	0	0.25	10.5
4	0.82	1.35	12.2
5	1.25	-	9.3
6	0	-	11.8
7	1.25	-	9.3

4.2.4 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the Multiplier Board, reference should be made to Section 3 Para 3.2 of this Manual for information regarding the use of soldering irons and measurement of transistor junction resistances.

Generally most fault-finding can be effected in the absence of an audio input. A carrier source at required frequency and a level of 300mV is required. A multimeter or H.F. valve voltmeter is likely to be the only test instrument required.

Initially check that the d.c. supplies measure 9V and 13.8V d.c. The 9V d.c. supply current should measure between 12 and 15mA with or without the carrier source connected. The 13.8V d.c. supply current should measure 10mA in the absence of the carrier source and 160mA with the carrier connected.

(A) Setting-up Procedure

i) Connect the milliwattmeter and 20db attenuator with mount to the filter output.

ii) Connect the signal generator to the Multiplier input and set to 22.7MHz (for 400-420MHz band) and 25.5MHz (for 450-470MHz band) at a level of 300mV.

iii) Depending on the alignment of the multiplier stages, power output may or may not be indicated on the output power meter. If power is indicated proceed with alignment as per paragraphs (B) iv) to (B) viii) inclusive. If power output is not indicated proceed as per steps (B) i) to (B) viii) inclusive.

(B) Tuning Procedure

i) Connect an RF voltmeter to the collectors of TR1, TR2 and TR3 in turn and observe that the radio frequency path is continuous to collector of the TR3.

ii) Connect the RF voltmeter to the junction of the resistors R17 and R18 and adjust the cores of L10, L11 and L12 for maximum RF voltage at this junction.

The phase modulator circuit, consisting of transistor TR1, diode D1 and capacitor C3, accepts the oscillator input at a level of 300mV and provides a phase modulated signal which is amplified by the broadband circuit comprising transistor TR2. Tripler transistor TR3 is forward biased by diode D2 and it's output is coupled by the inductor L13 and the capacitor C10 to the broadband tunable bandpass filter consisting of inductors L10, L11, L12 and the capacitors C11, C12, C13, C15, C16 and C17. This filter prevents the fundamental and harmonic frequencies of the input signal other than the third harmonic from reaching the input of the transistor amplifier TR4 with any significant amplitude. The collector circuit of transistor TR4 is tuned to the tripler frequency by means of the bandpass filter L7, C19, L8, C26, C27, the output of which drives the frequency doubler comprising the transistors TR5 and TR7. The output of the doubler stage is tuned to the second harmonic of it's input frequency and drives the amplifier transistor TR6. The output of TR6 drives the varactor diode tripler stage D3 to produce the required signal with a frequency in the band 400 to 470MHz, at a level suitable for driving the final broadband transmitter amplifier.

The tripler output is coupled to the external bandpass filter by means of C24 and L6 before being impressed on the transmitter amplifier input.

Carrier input freq.	=	25 to 26.1MHz or 22.2 to 23.3MHz
Carrier input level	=	600mV e.m.f. (300mV p.d.)
Carrier input impedance	=	50Ω unbalanced
Mod. input freq.	=	100 to 3000Hz
Mod. input level	=	approx. 100mV
Output freq.	=	450 to 470MHz or 400 to 420MHz
F.M. deviation	=	5 to 15KHz as specified for 25 or 50KHz equipment respectively
Output level	=	200mW maximum
Output impedance	=	50Ω unbalanced

Item	Circuit Function	Description	Other Reference	STC Part No.
TR3	Emitter Follower	Small Sig. Silicon	BC109A	295910
TR4	Emitter Follower	Small Sig. Silicon	BC109A	295910
TR5	De-Emph. Amp.	Small Sig. Silicon	BC109A	295910

Item	Circuit Function	Description	Other Reference	STC Part No.
C18	Coupling	.47uF +50 -20% 35VW	37C-CA52-147KRA	260434
C19	Feedback	.047 ± 10% 250VW	MRC-CA43-647ALA	342954
C20	Bypass	.001uF +80 -20% 500VW	MRC-CA33-510JSG	342938
C21	Filter	33uF +80 -20% 10VW	(RS-533-05-A) 37C-CA52-333CNC	260449
C22	Coupling	4.7uF (25 Solid Tant)	(Tag) 37C-CA52-247HRA	260440
C23	Bypass	22uF +50 -20% 6VW	37C-CA52-322BRA	289701
		INDUCTORS		
L1	Filter	3.3uH ± 10%	(TP-0410 L-3R 3K) MRC-CLOO-13300B	342875
		RESISTORS		
R1	Load	33KΩ ± 5% CR25	MRC-RS12-433AMK	342906
R2	Emitter	1.5KΩ ± 5% CR25	MRC-RS12-315AMK	342919
R3	Bias	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R4	Bias	15KΩ ± 5% CR25	MRC-RS12-415AMK	342910
R5	Not used			
R6	Bias	2.2KΩ ± 5% CR25	MRC-RS12-322AMK	342918
R7	Feedback	33KΩ ± 5% CR25	MRC-RS12-433AMK	342906
R8	Bias	3.3KΩ ± 5% CR25	MRC-RS12-333AMK	342917
R9	Load	3.3KΩ ± 5% CR25	MRC-RS12-333AMK	342917
R10	Emitter	1KΩ ± 5% CR25	MRC-RS12-310AMK	342921
R11	Bias	10KΩ ± 5% CR25	MRC-RS12-410AMK	342911
R12	Bias	150KΩ ± 5% CR25	MRC-RS12-515AMK	342901
R13	Bias	10KΩ ± 5% CR25	MRC-RS12-410AMK	342911
R14	Bias	100KΩ ± 5% CR25	MRC-RS12-510AMK	342902
R15	Bias	47KΩ ± 5% CR25	MRC-RS12-447AMK	342904
R16	Part of L.P. Filter	18KΩ ± 2% MR25	MRC-RS15-418DFA	342888
R17	Part of L.P. Filter	22KΩ ± 2% MR25	MRC-RS15-422DFA	342887

(vii) Check that, with an input frequency of 6000Hz at a level of 100uV, the output reading does not exceed 500uV.

(viii) Using the oscilloscope, check that the output waveform is symmetrical and free from distortion.

B. Clipper Check

(i) Increase the input level to 2mV at 1000Hz and adjust potentiometer R26 such that the waveform clips at the peaks, as viewed on the oscilloscope.

(ii) Increase the input level to 20mV and check the frequency response over the range 300 to 3000Hz.

Note: The response should measure +10db at 300Hz and -10db at 3000Hz, relative to 1000Hz.

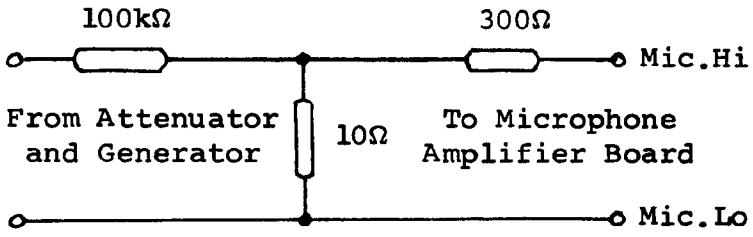
Input Frequency	=	300 to 3500Hz
Input Level	=	approx. 2mV E.M.F. (1mV pd.)
Input Impedance	=	nominally 300Ω unbalanced
Output Level	=	Approx. 100mV

4.1.3 Recommended Test Equipment

The following list includes recommended types of test instruments when it is required to carry out extensive tests on the board assembly when the test equipment specified is not available, equivalent types may be used.

i) Audio signal generator and 3 db attenuator (Advance type J2)

ii) Impedance matching network as shown below



iii) Valve voltmeter (Advance type 77)

iv) Oscilloscope (Serviscope S51)

v) Multimeter (Avometer Model 8)

vi) 9V D.C. supply

4.1.4 Fault Location

All measurements are to be regarded as typical.

Before attempting to isolate a fault on the Microphone Amplifier Board, reference should be made to Section 3 Para 3.2 of this manual for information regarding the use of soldering irons and measurements of transistor junction resistances.

Generally, most fault finding on the board can be carried out using a multimeter, audio signal source and an oscilloscope.

To check the board function apply an input of 100uV at 1000Hz to the telephone input terminals and trace the signal path circuit. The input to the clipper should be approximately 20mV. The output should measure approximately 10mV.

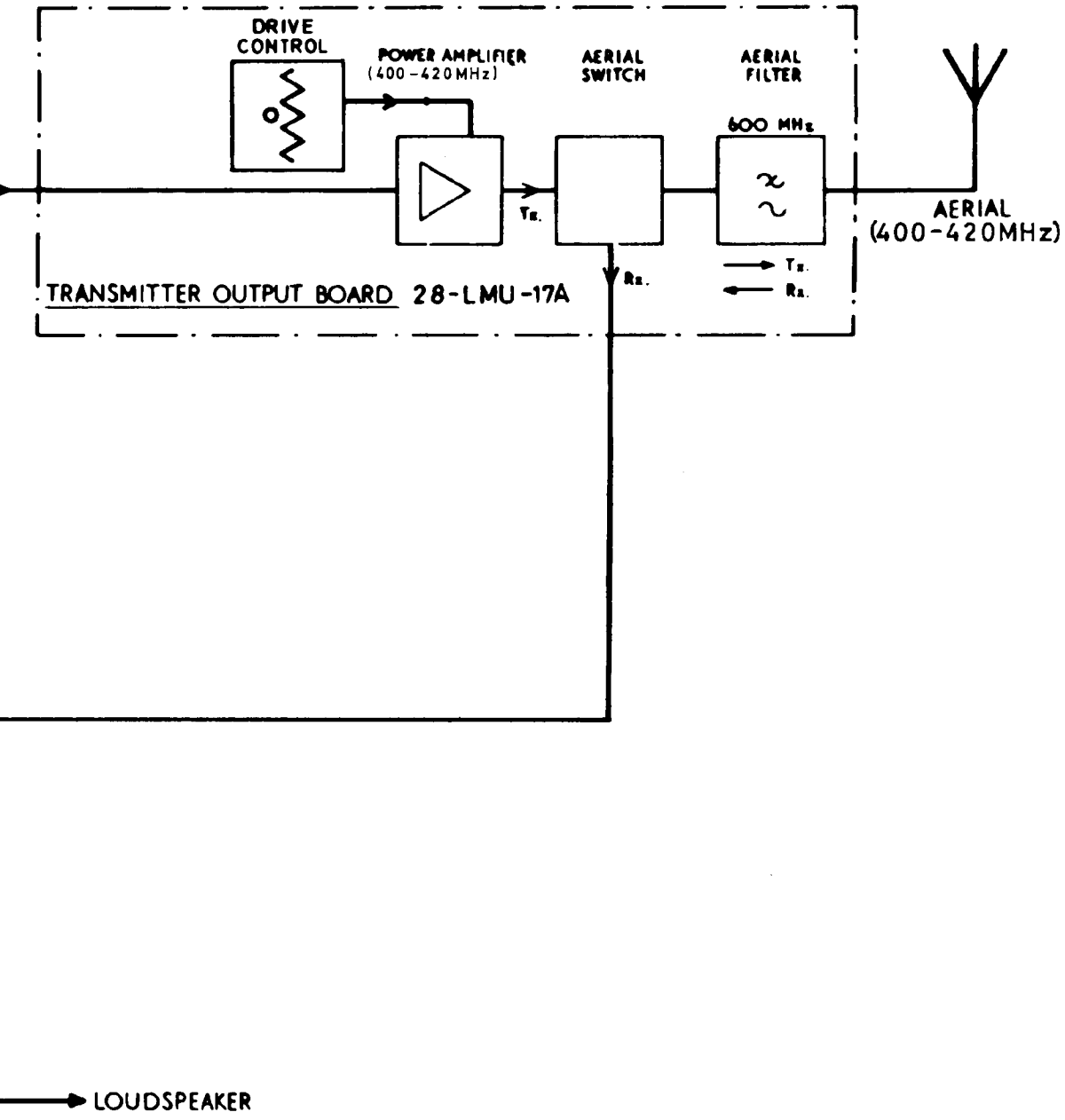
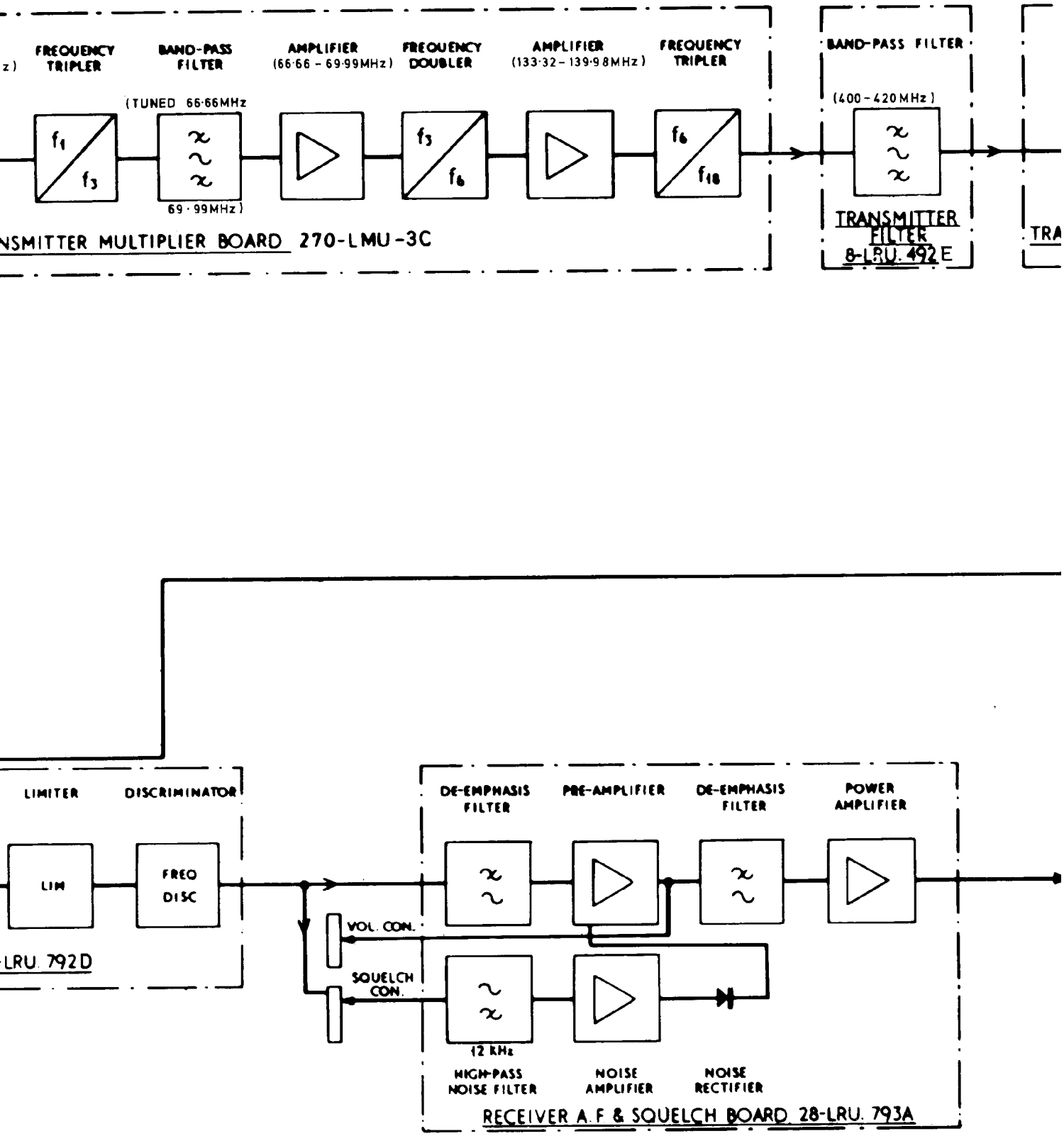
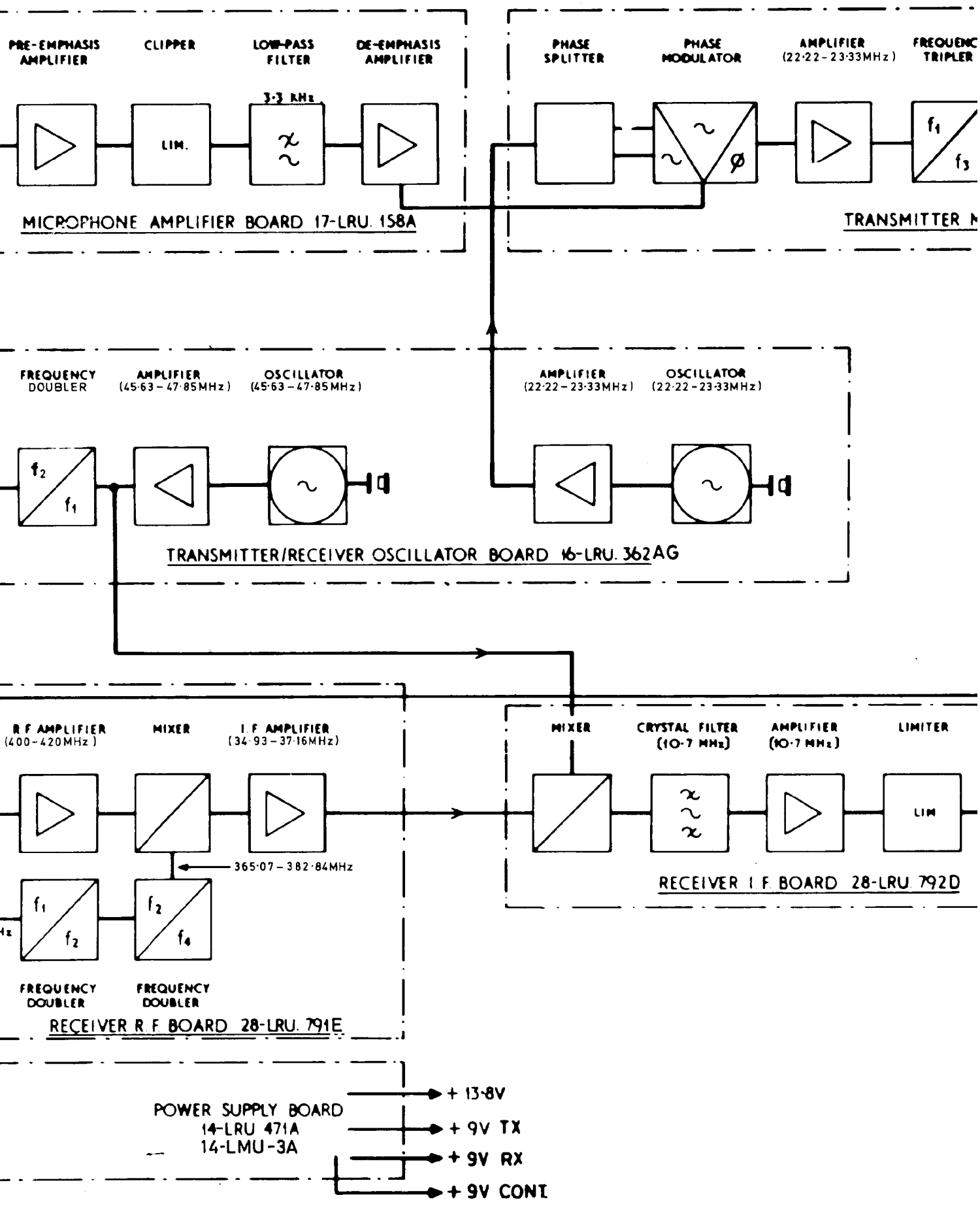


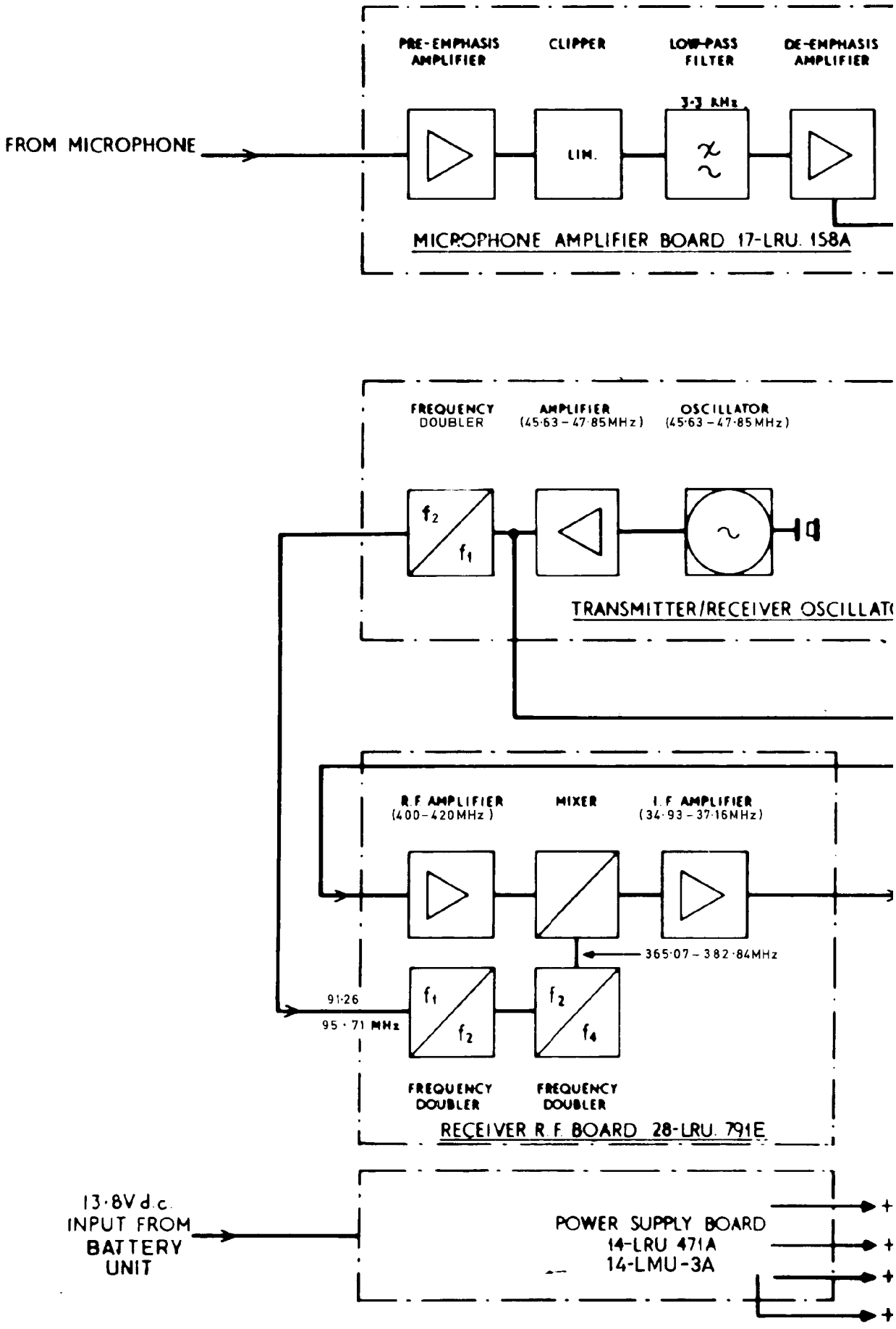
FIG 1

BLOCK DIAGRAM OF MTR191C EQUIPMENT

FIG 1







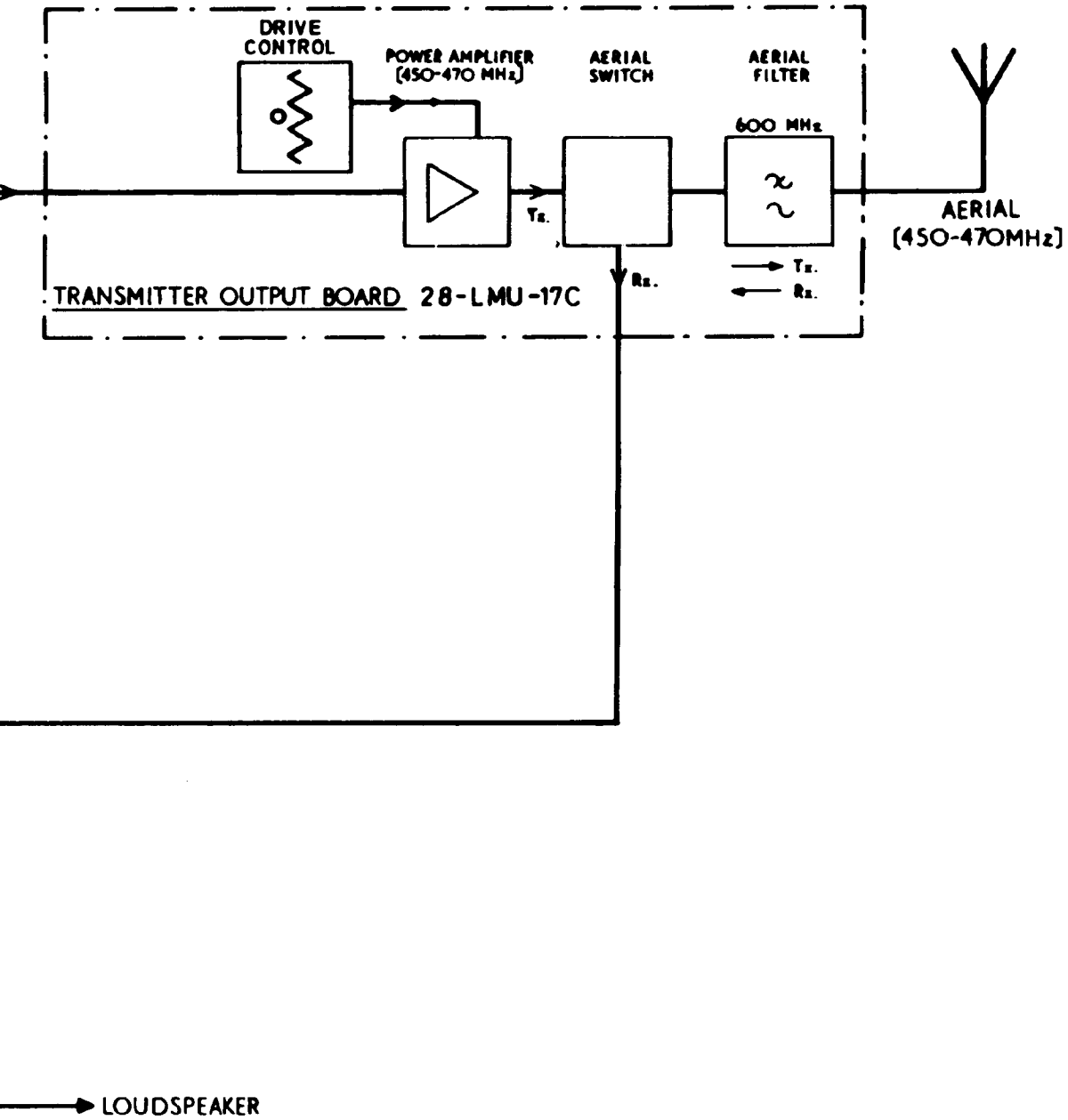
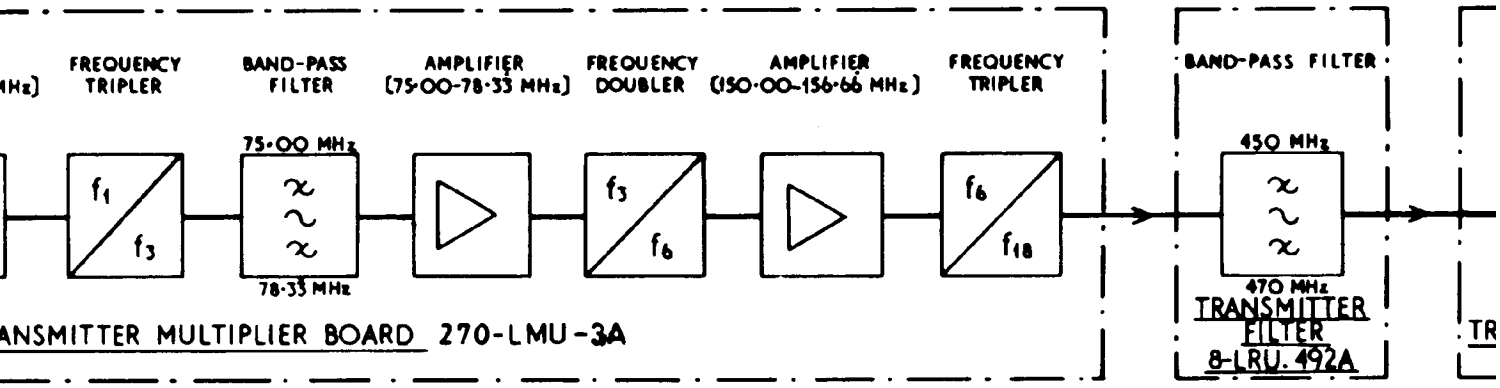
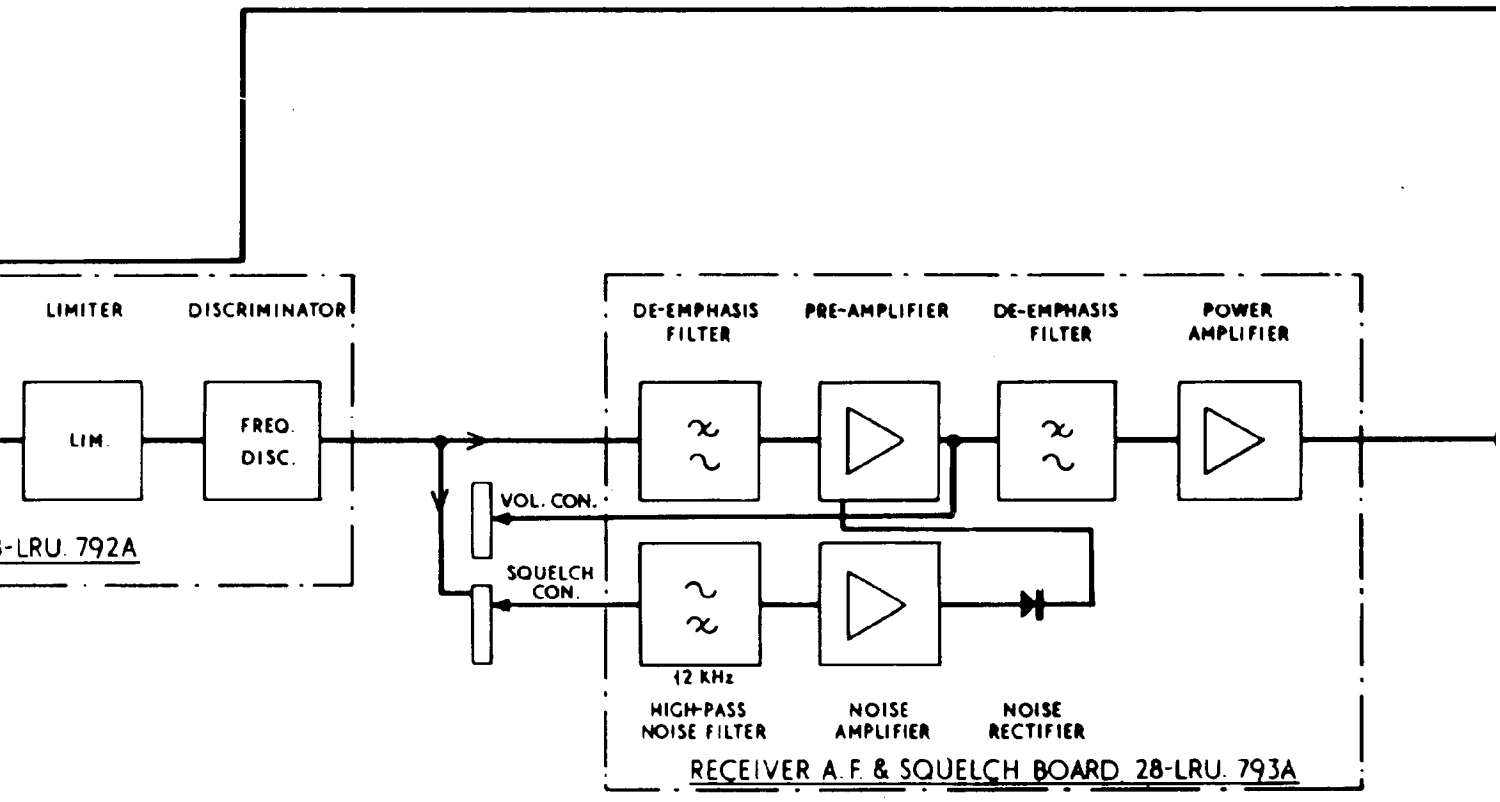


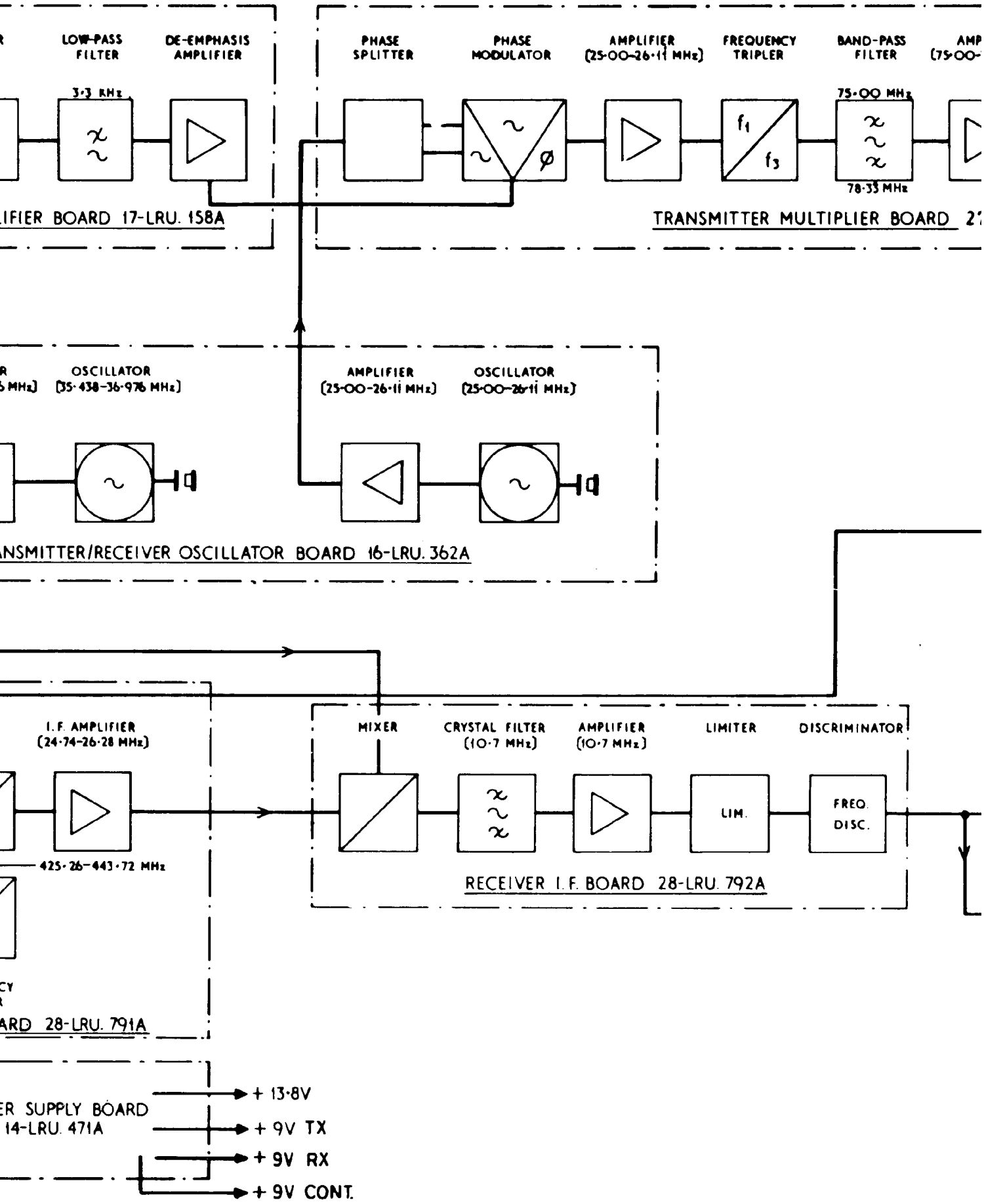
FIG. 2

BLOCK DIAGRAM OF MTR191D EQUIPMENT

FIG. 2







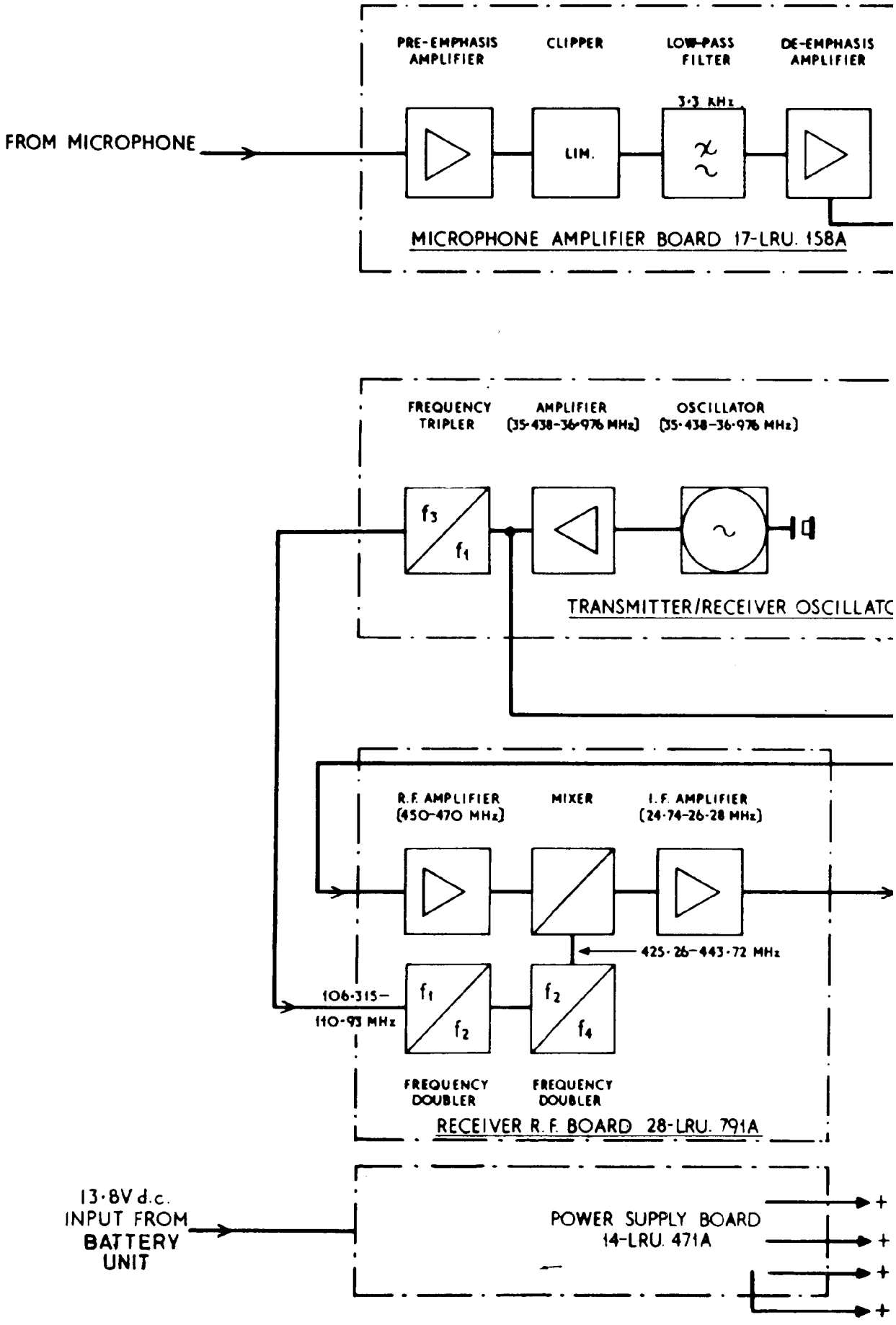
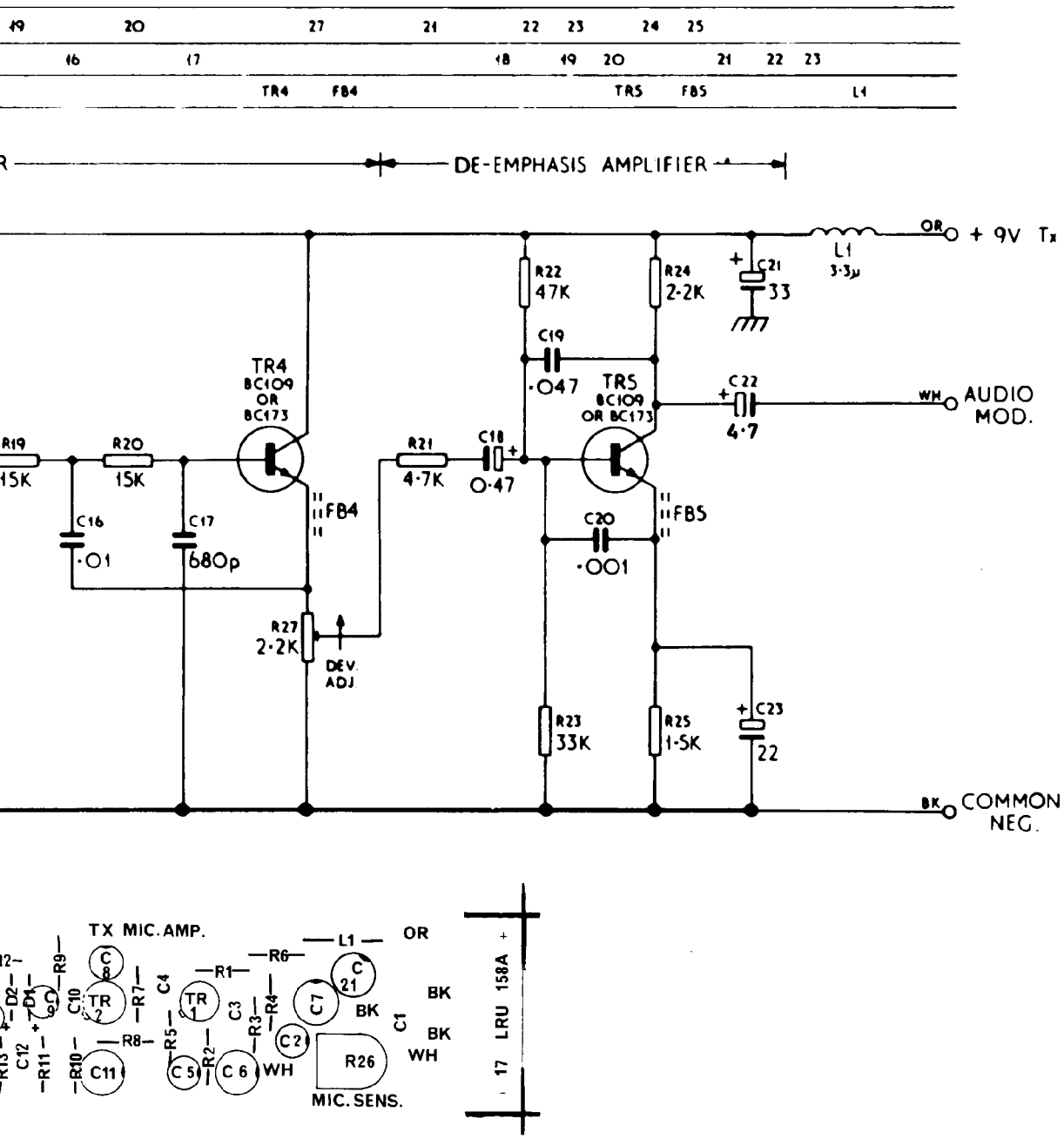


FIG. 3

342044

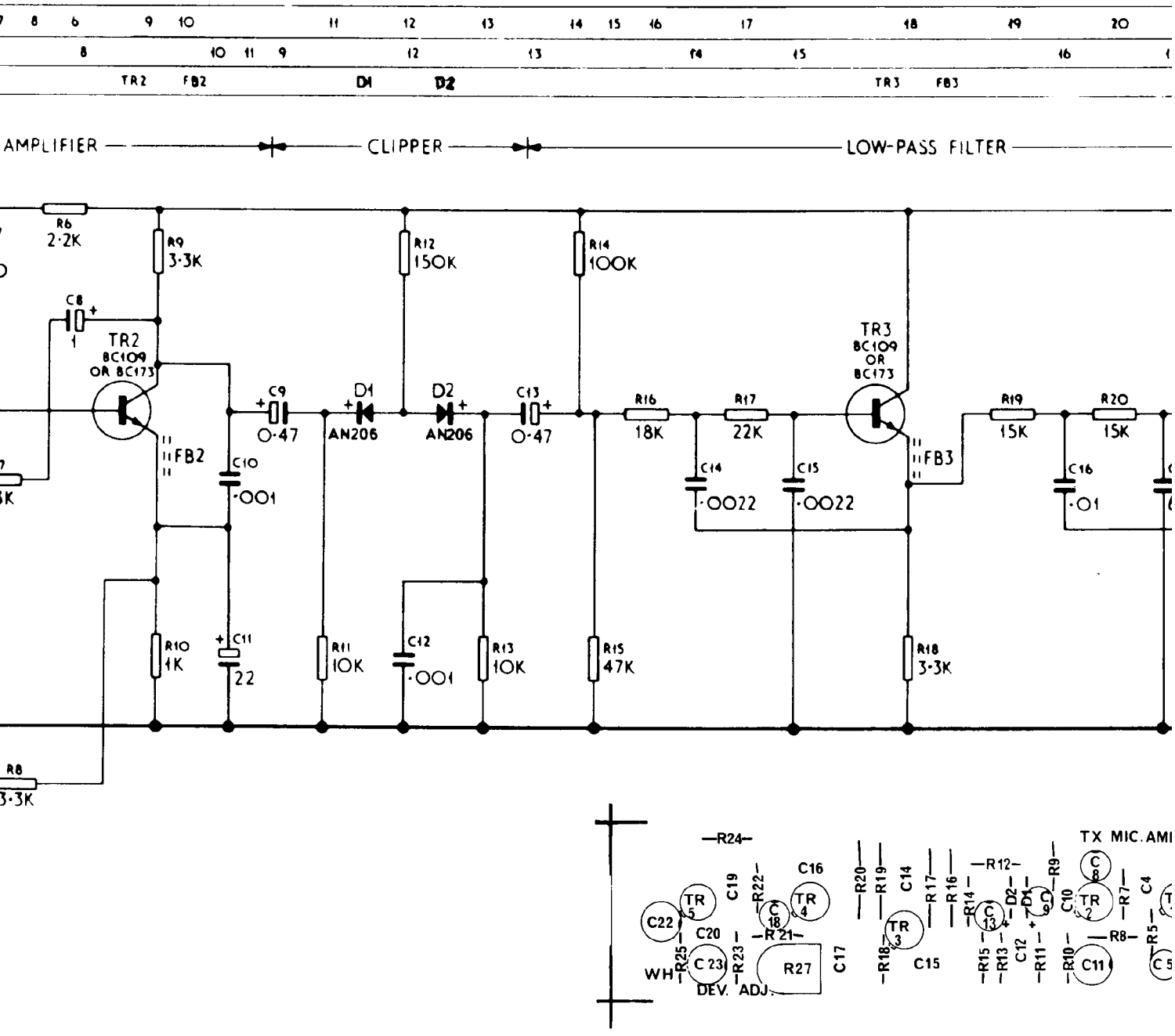
MICROPHONE AMPLIFIER BOARD

17-LRU-158A



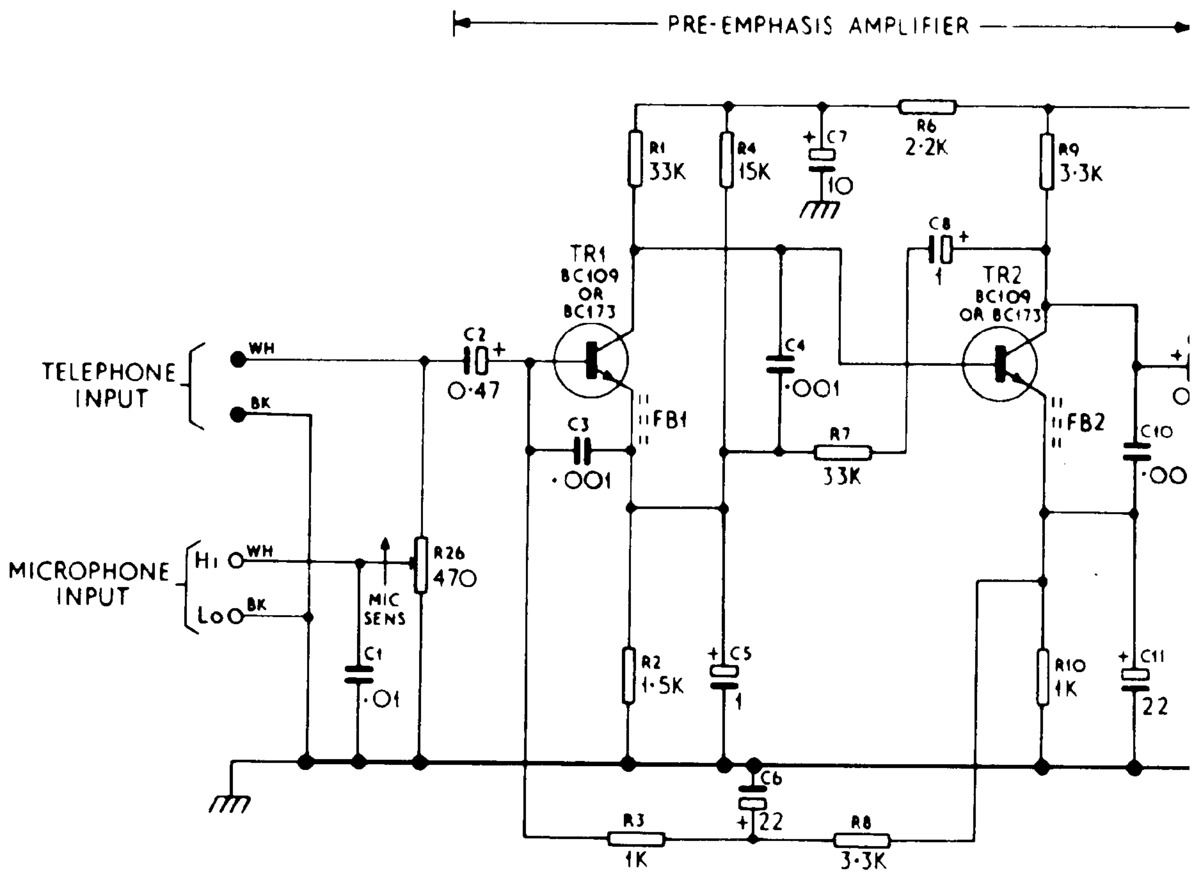
omponent Code actual size.

FIG. 3

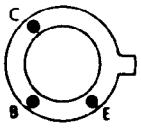


p.c.b. Component Code actua

RESISTORS	26 1 2 3 4 7 8 6 9 10
CAPACITORS	1 2 3 5 6 4 7 8 10 11
MISCELLANEOUS	TR1 FB1 TR2 FB2

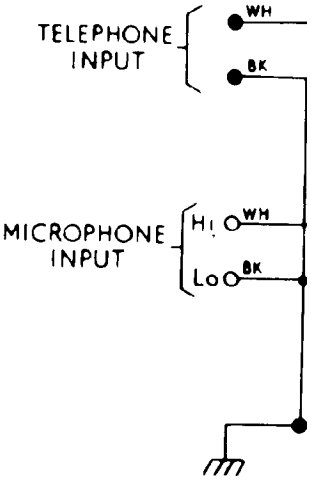


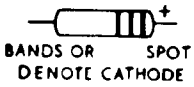
RESISTORS
CAPACITORS
MISCELLANEOUS



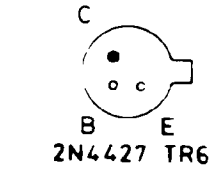
BC109 TR1, TR2, TR3, TR4, TR5

BC173 TR1, TR2, TR3, TR4, TR5
(ALTERNATIVE TYPE)

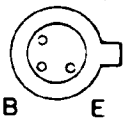




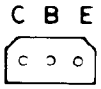
AN206 D1, D2



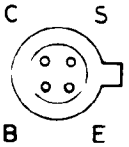
2N4427 TR6



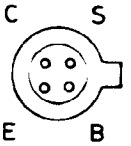
BSX19 TR5, TR7
MM1914 TR3



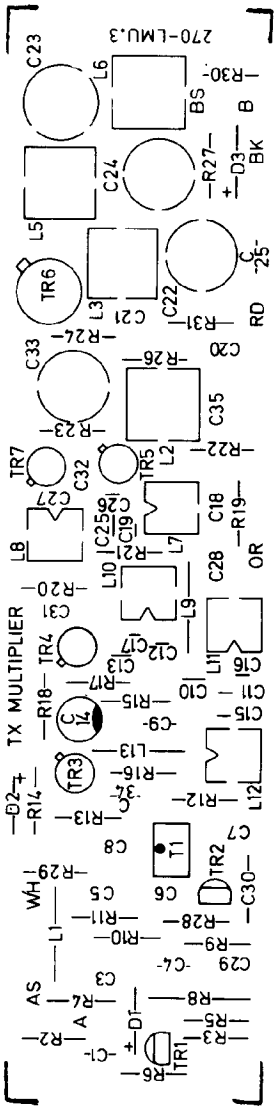
ZTX320 TR1, TR2
ALTERNATIVE



2N918 TR1, TR2

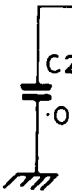


BF173 TR4

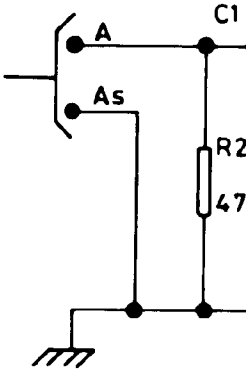


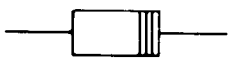
p.c.b. Component Code actual size.

RESISTORS	2
CAPACITORS	29
MISCELLANEOUS	



INPUT FROM
TRANS REC. OSC. BOARD
OR TRANS. OSC. BOARD
22·22 - 23·33 MHz

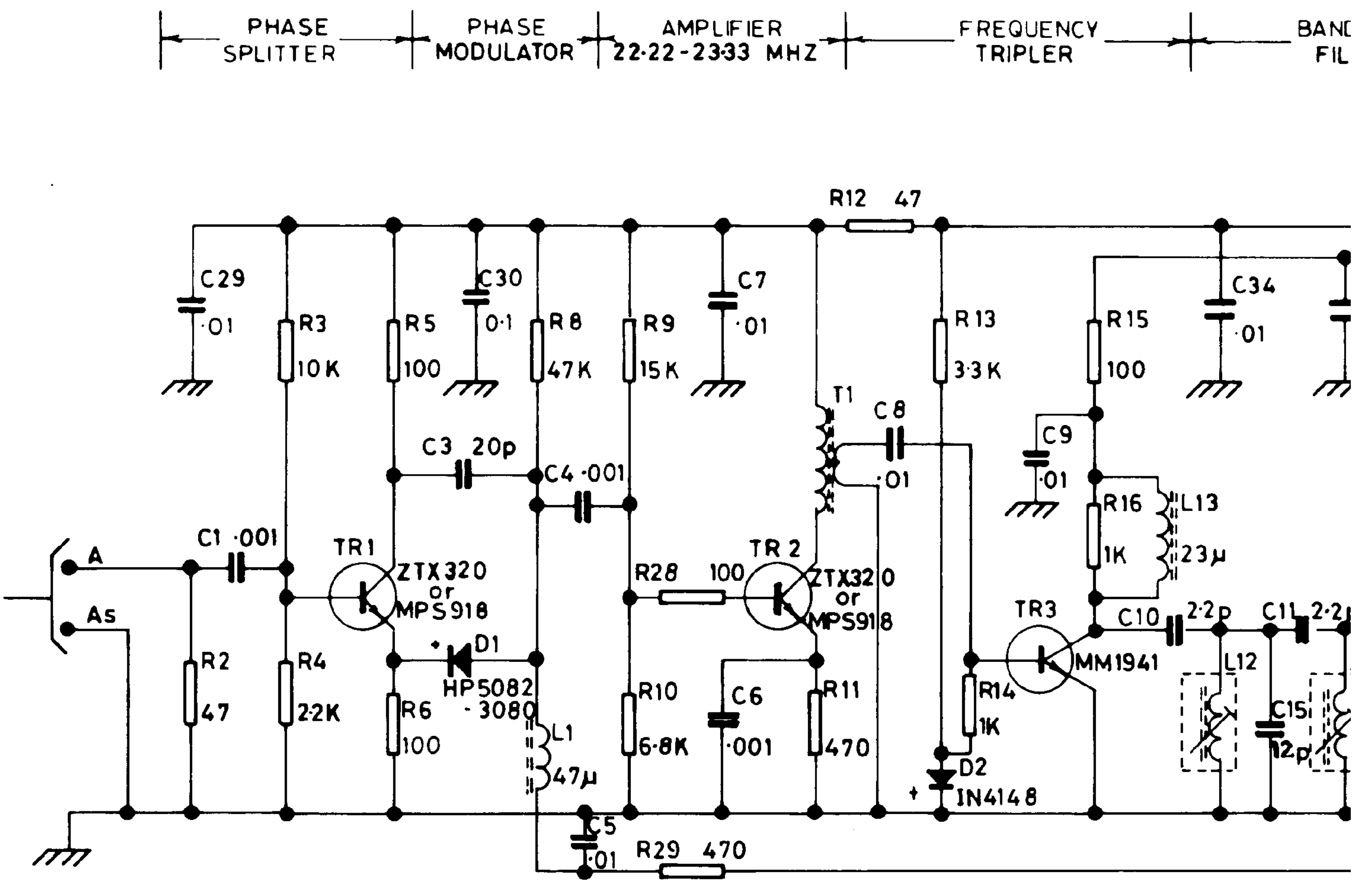




D1 HP5082-3080
D2 1N4148
D3 FRB124

BANDS OR RED SPOTS
DENOTE CATHODE

	2 3 4 5 6 8 9 28 10 29 12 11 13 14 15 16
	29 1 3 30 4 5 7 6 8 9 10 34 15 11 14
EOUS	TR1 D1 L1 TR2 T1 D2 TR3 L13 L12 L11



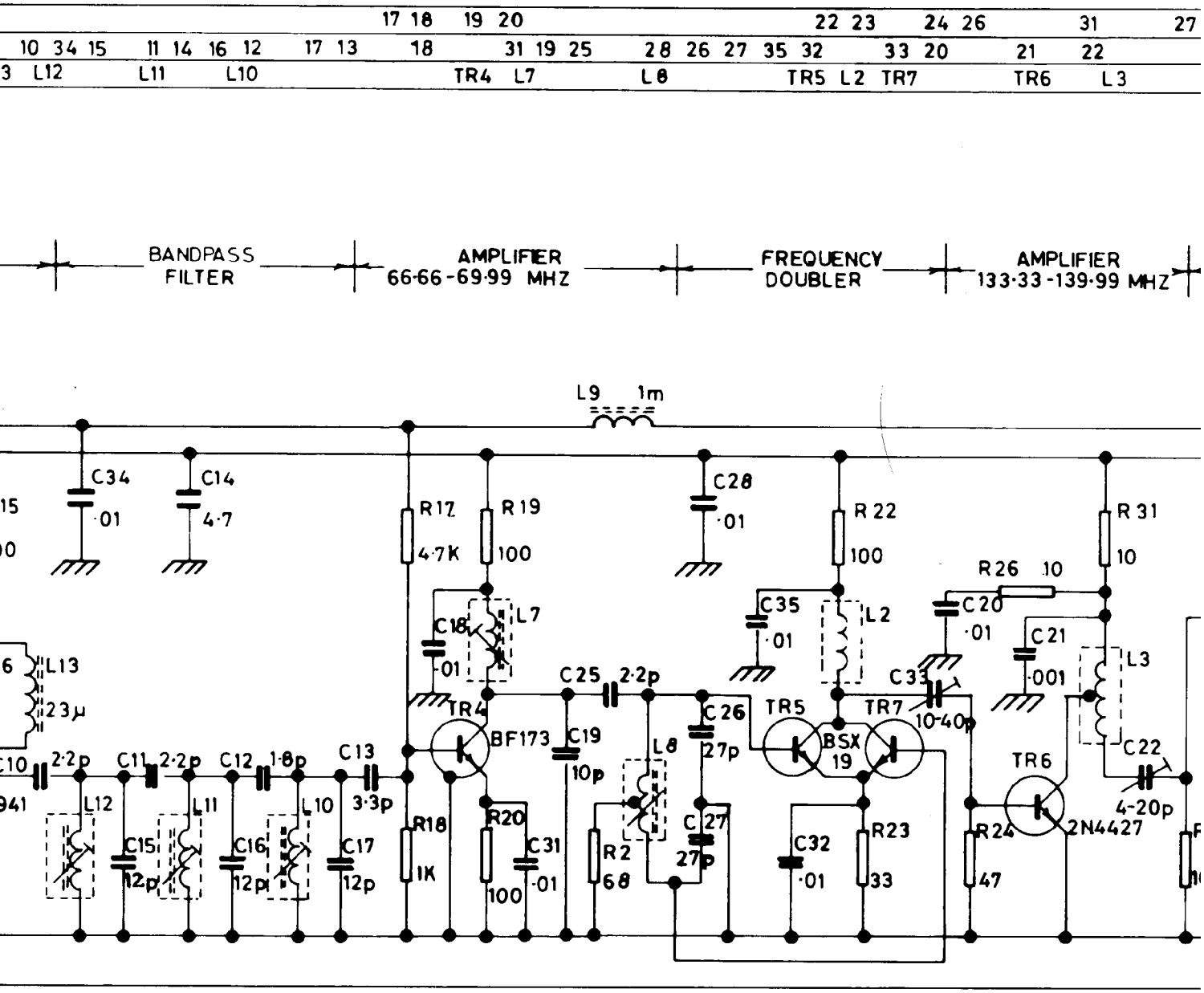


FIG 4

342182

MULTIPLIER BOARD

Transmitter

270-LMU-3C

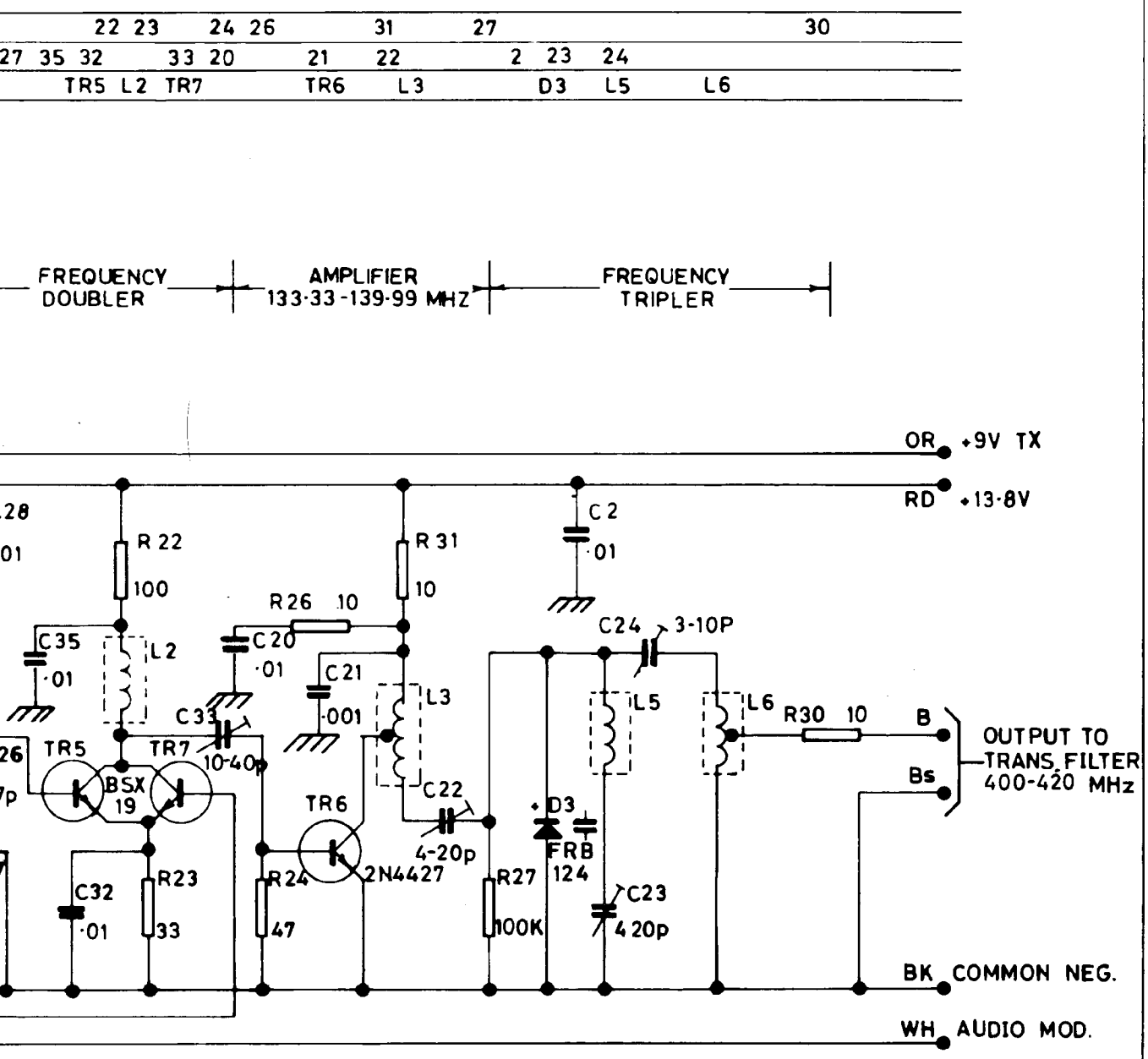
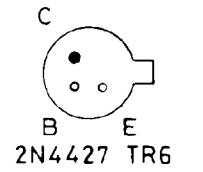
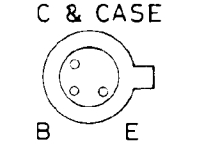


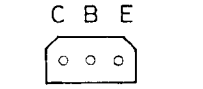
FIG 4



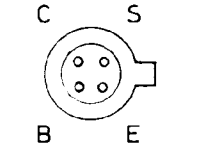
2N4427 TR6



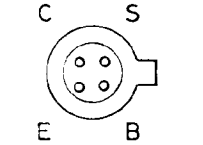
BSX19 TR5, TR7
MM1914 TR3



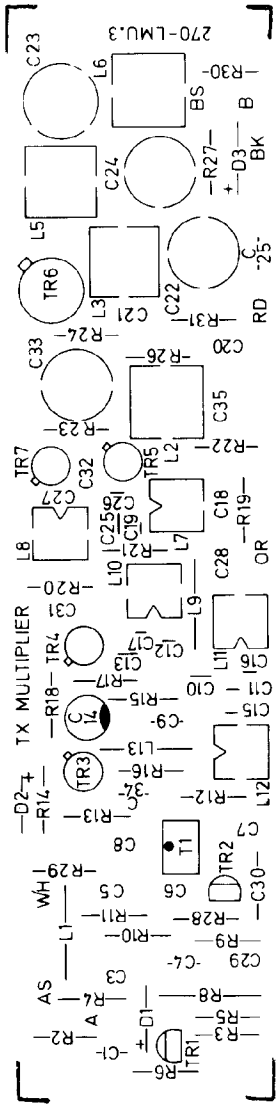
ZTX320 TR1, TR2
ALTERNATIVE



2N918 TR1, TR2

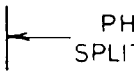


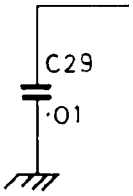
BF173 TR4



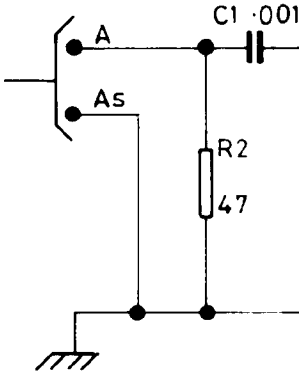
p.c.b. Component Code actual size.

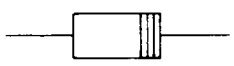
RESISTORS	2
CAPACITORS	29 1
MISCELLANEOUS	





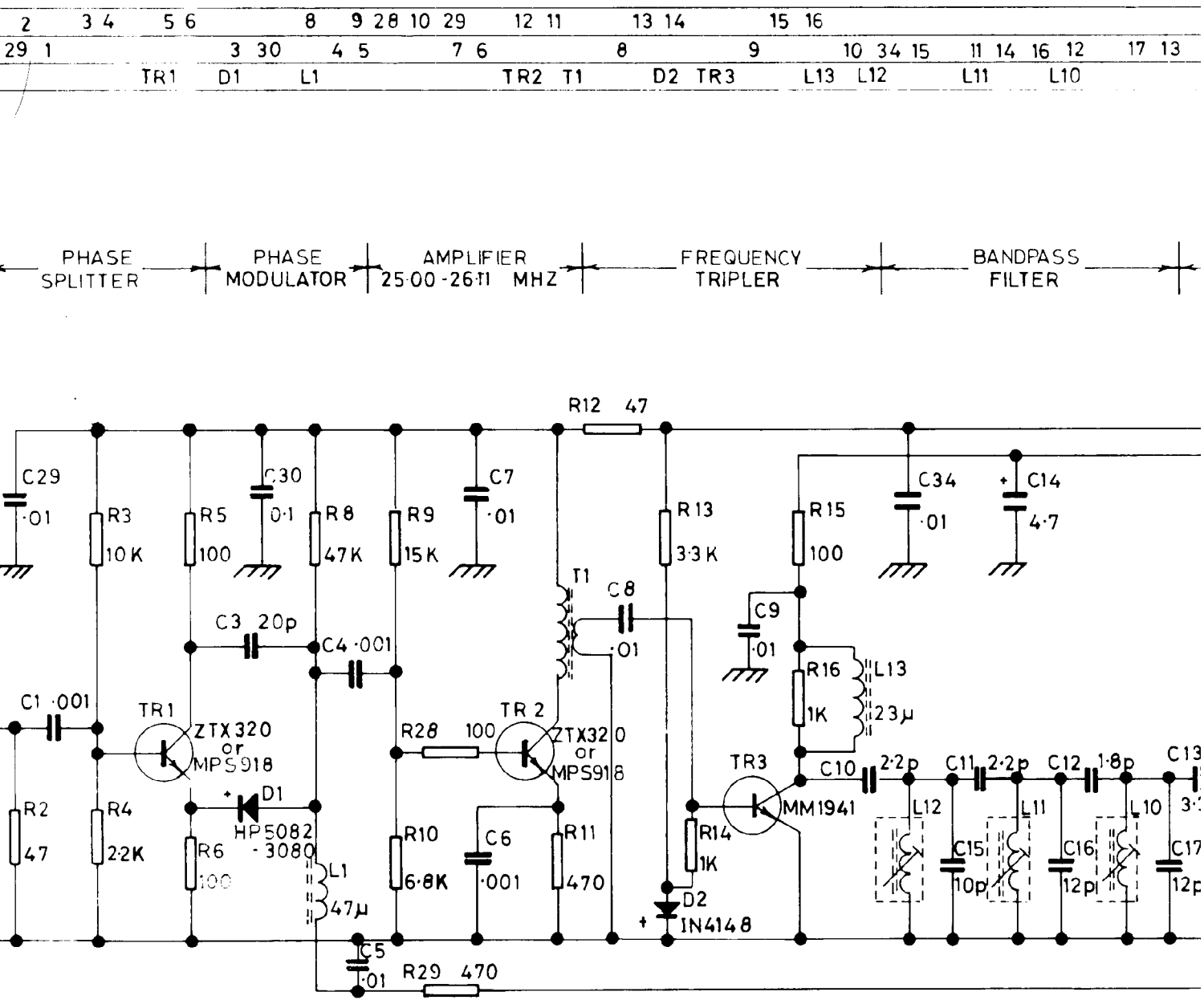
INPUT FROM
TRANS. REC. OSC. BOARD
OR TRANS. OSC. BOARD
25·00-26·11 MHz.





D1 HP5082-3080
D2 1N4148
D3 FRB124

BANDS OR RED SPOTS
DENOTE CATHODE



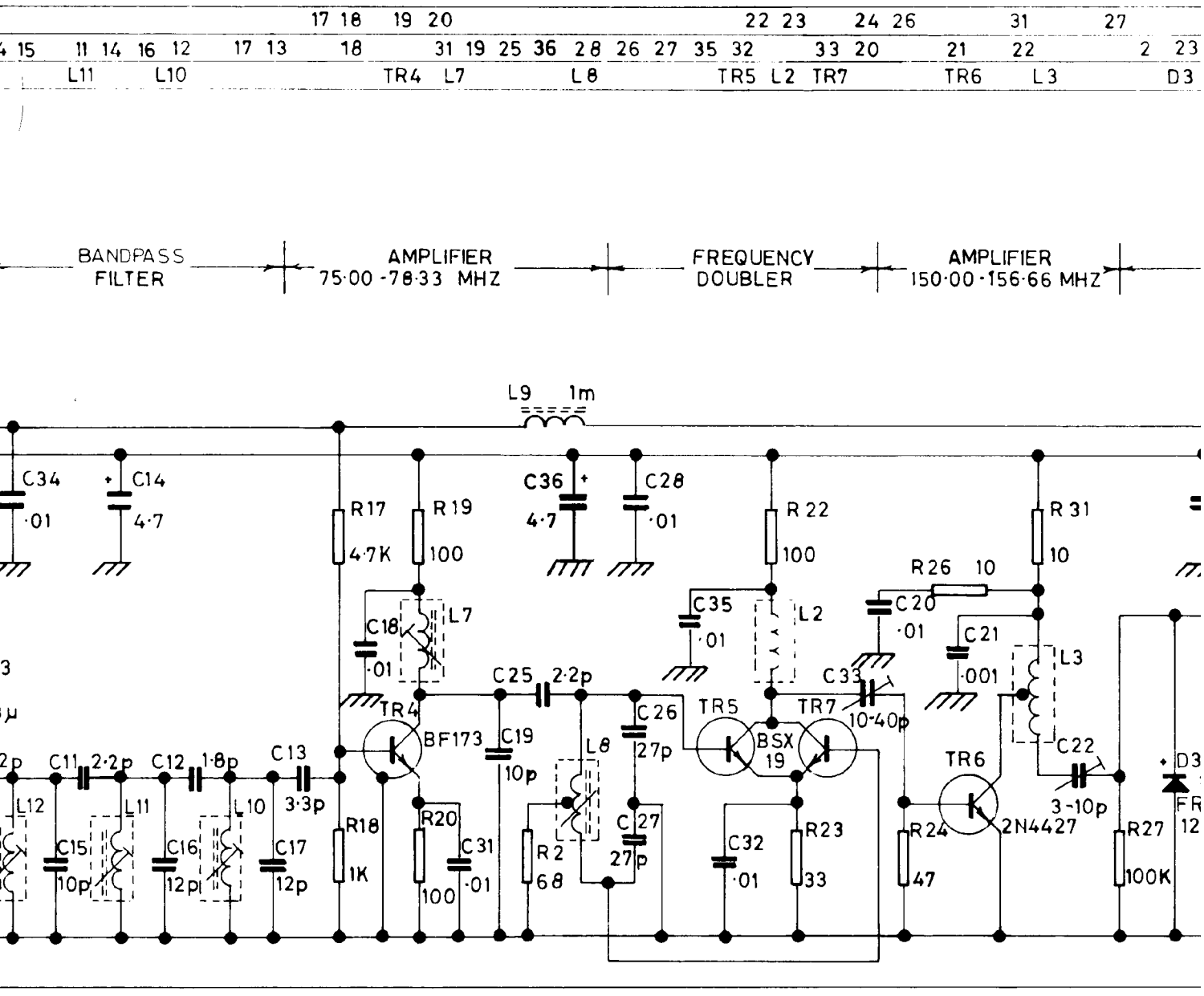
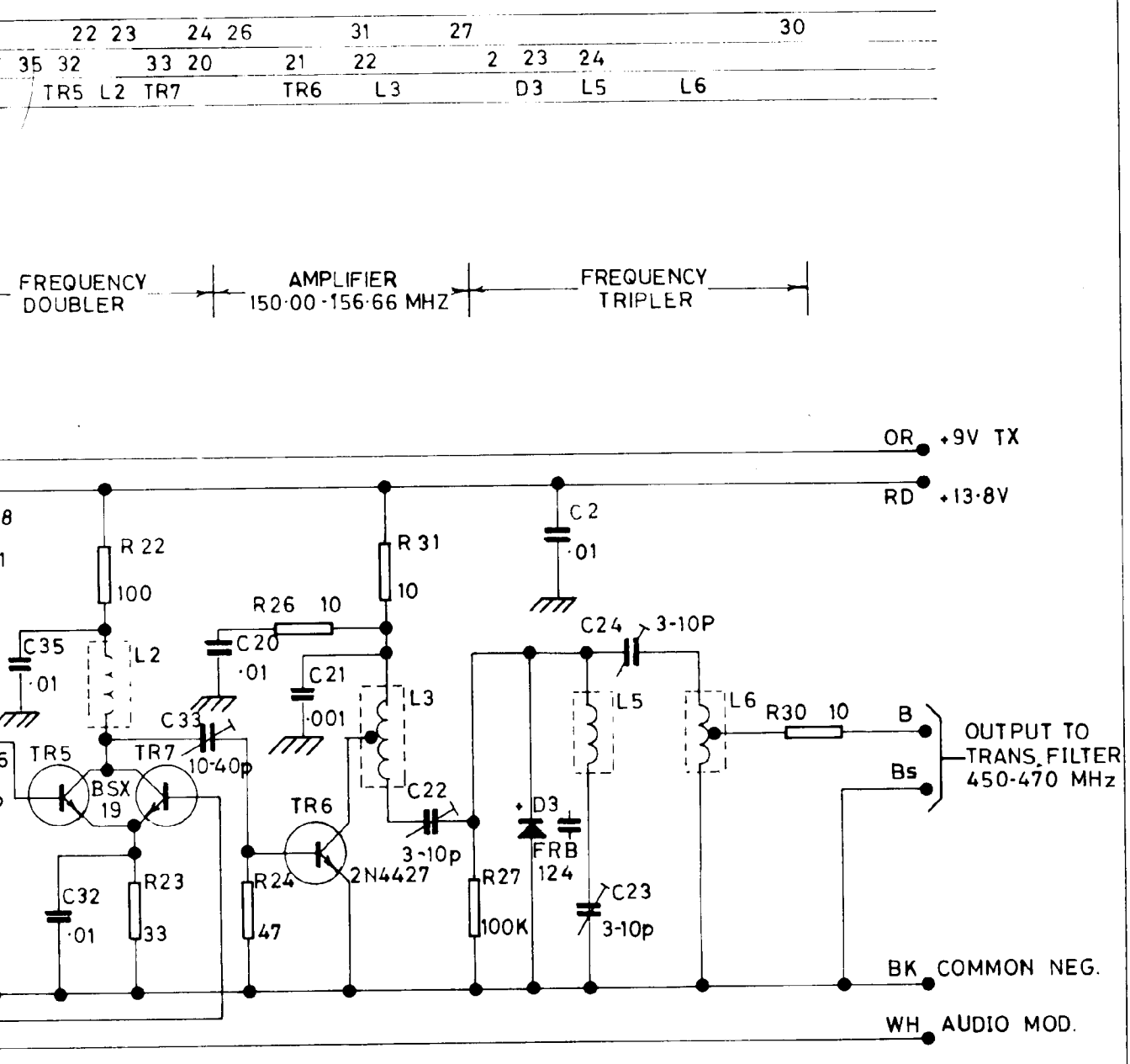


FIG 5

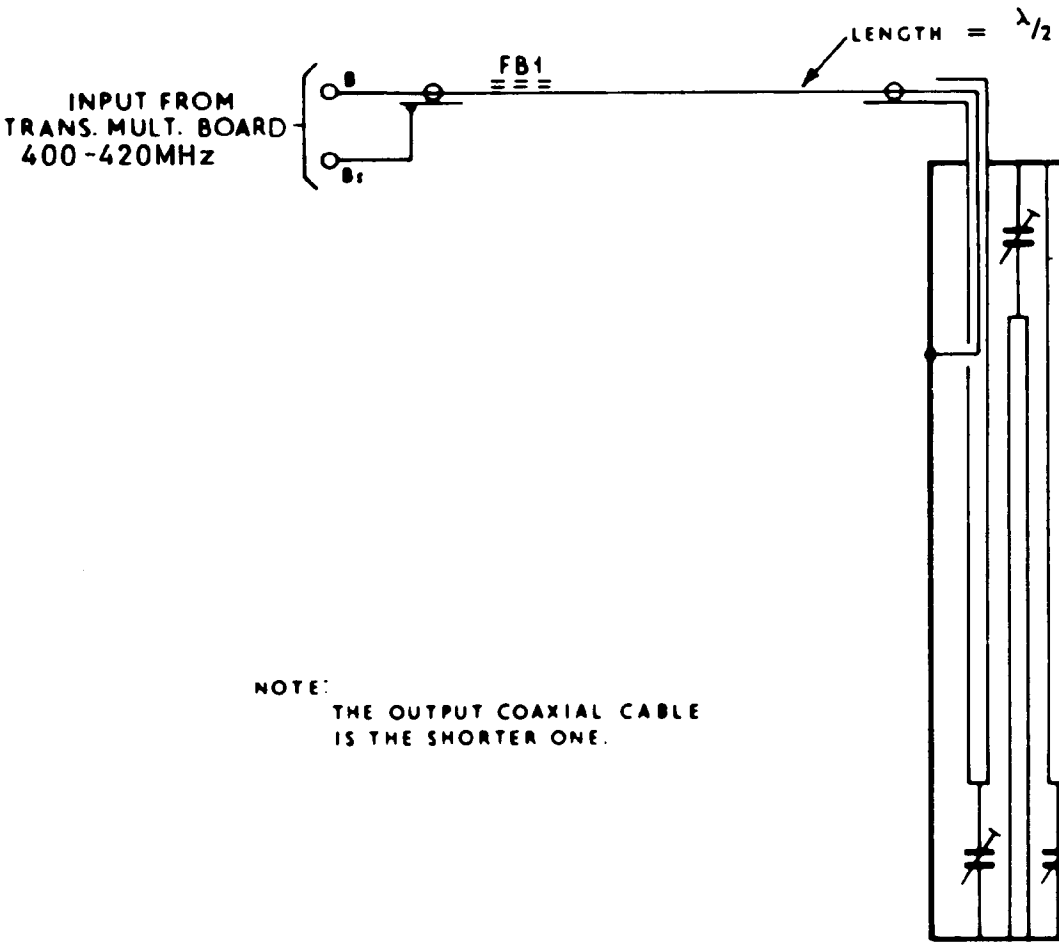
342031



MULTIPLIER BOARD Transmitter

270-LMU-3A

FIG 5



NOTE:
THE OUTPUT COAXIAL CABLE
IS THE SHORTER ONE.

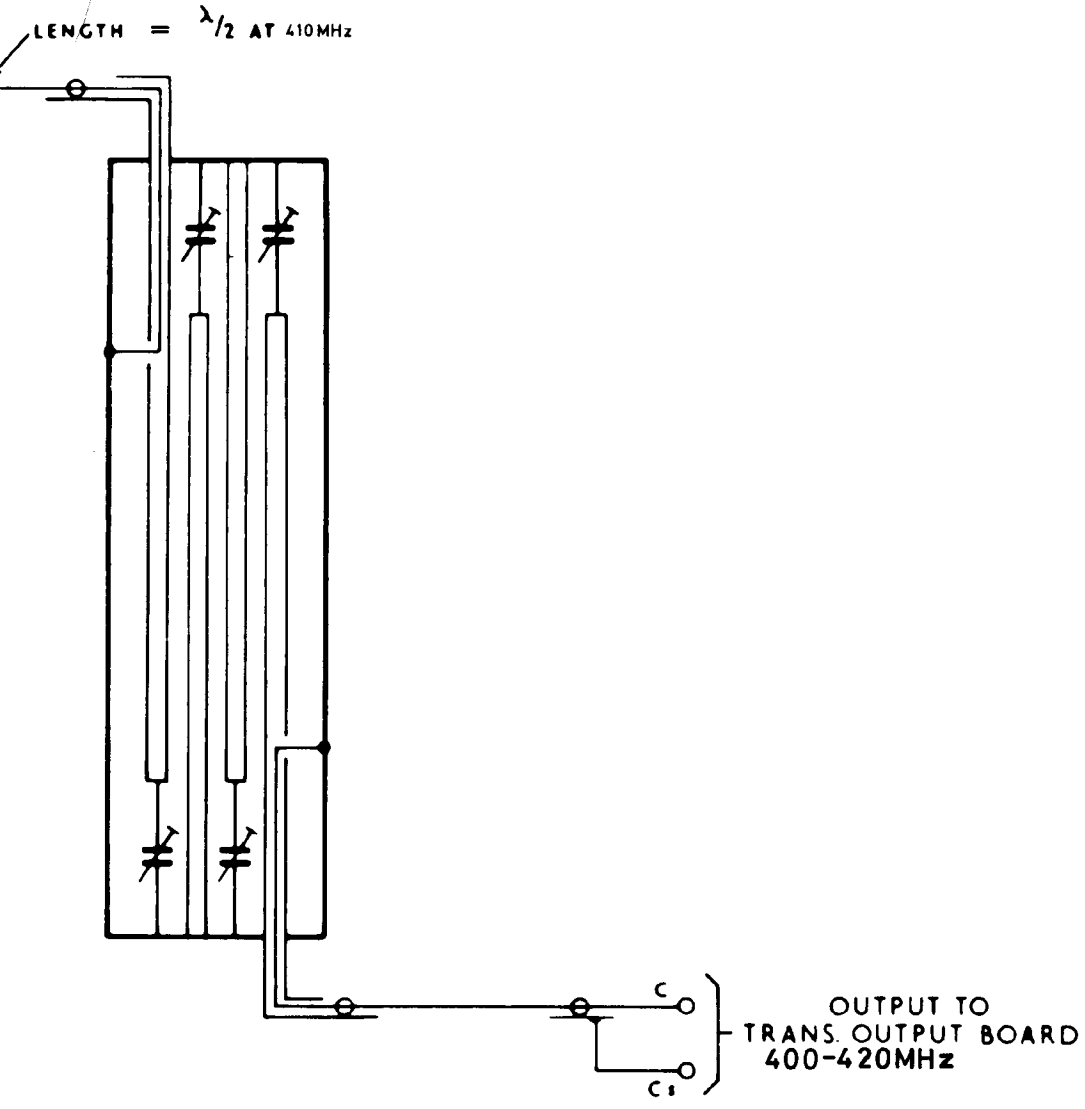


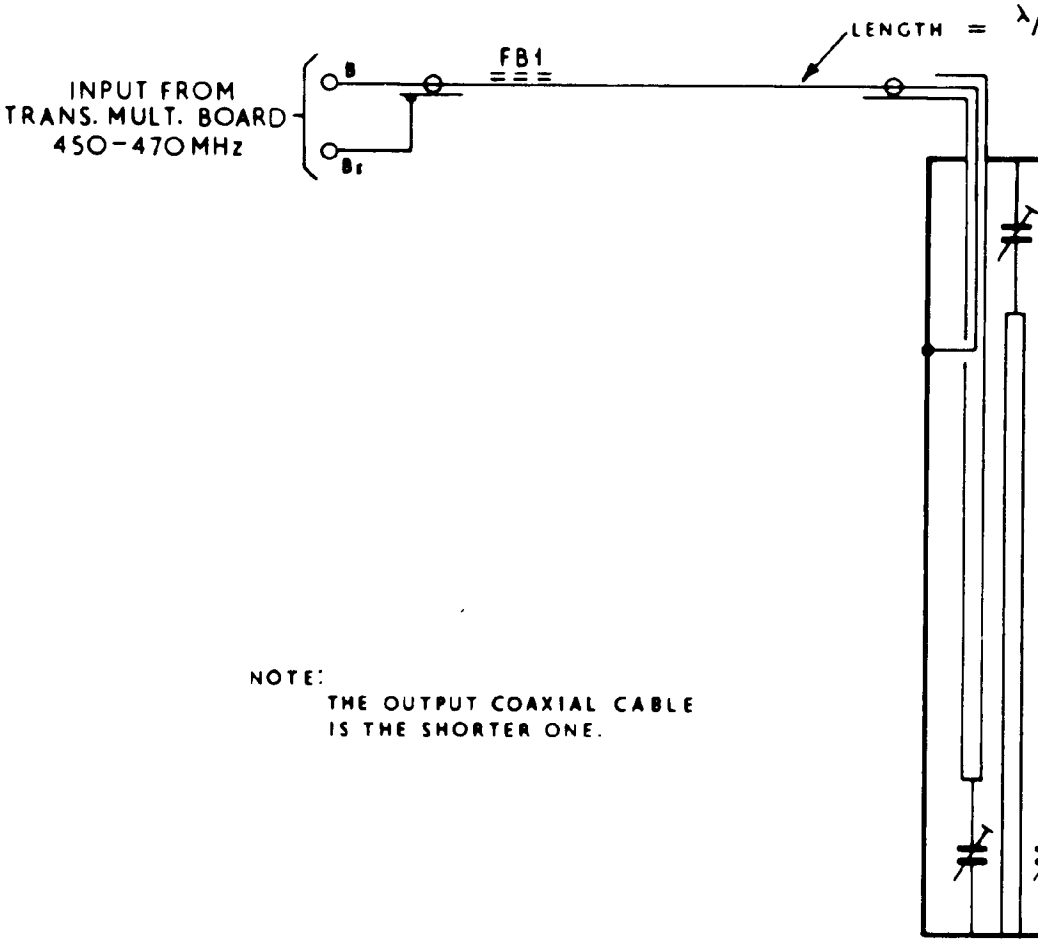
FIG. 6

342183

TRANSMITTER FILTER

8-LRU-492E

FIG. 6



NOTE:
THE OUTPUT COAXIAL CABLE
IS THE SHORTER ONE.

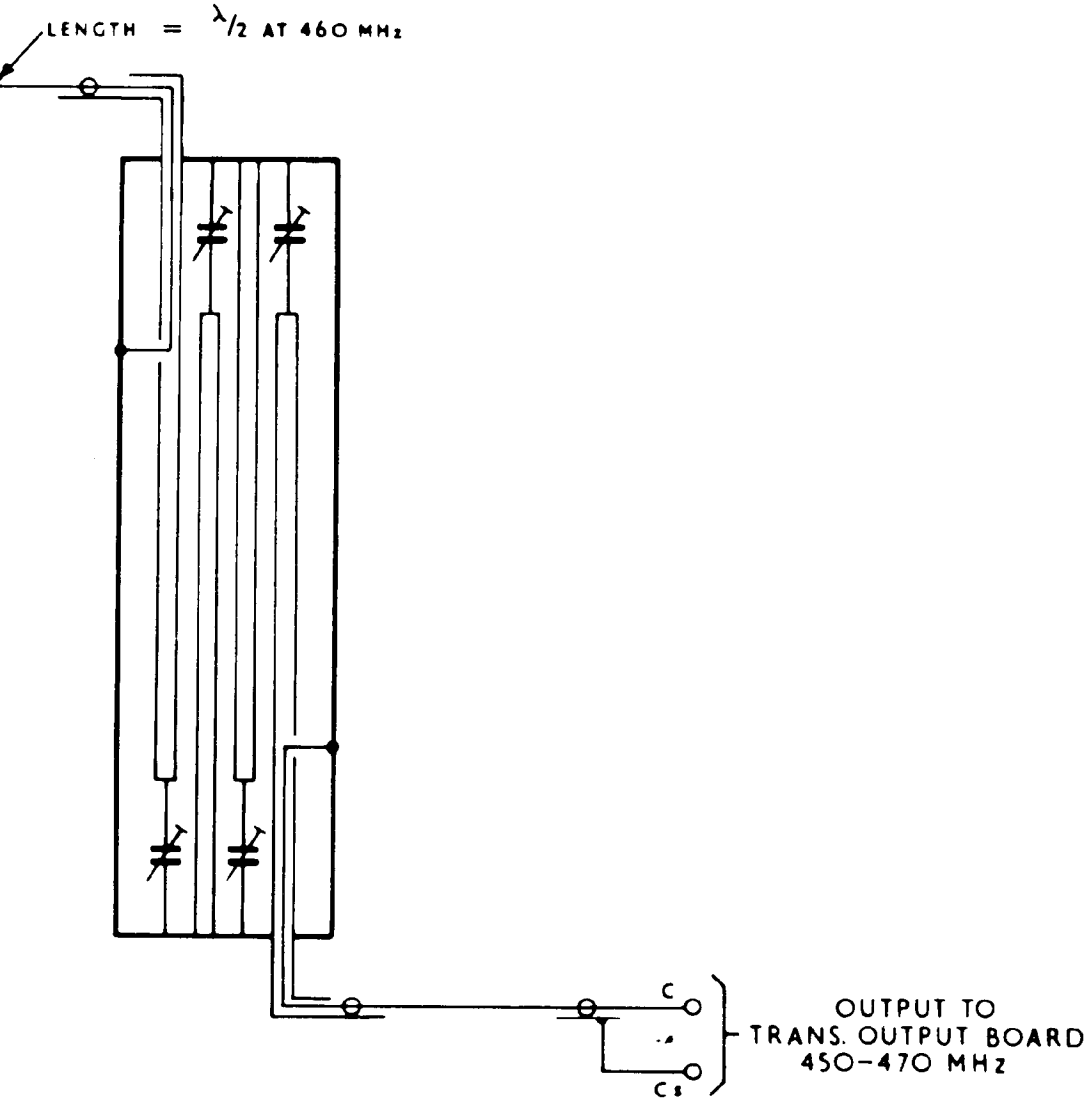


FIG. 7

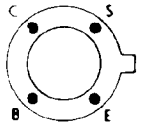
342000

TRANSMITTER FILTER

8-LRU-492A

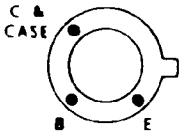
FIG. 7

RESISTORS	1 2
CAPACITORS	1 2
MISCELLANEOUS	FB1



2N918 TR1, TR2, TR3, TR4, TR5

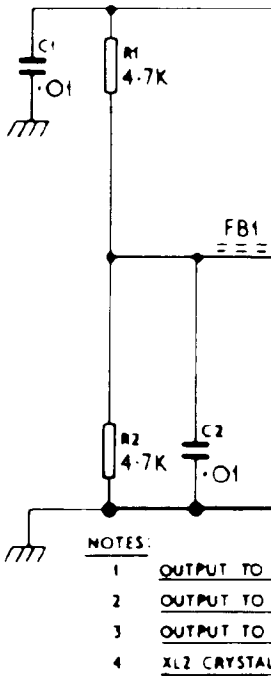
ZTX320 TR2 TR4 (ALTERNATIVES)
* EARTH CONNEXION ON BOARD
NOT USED

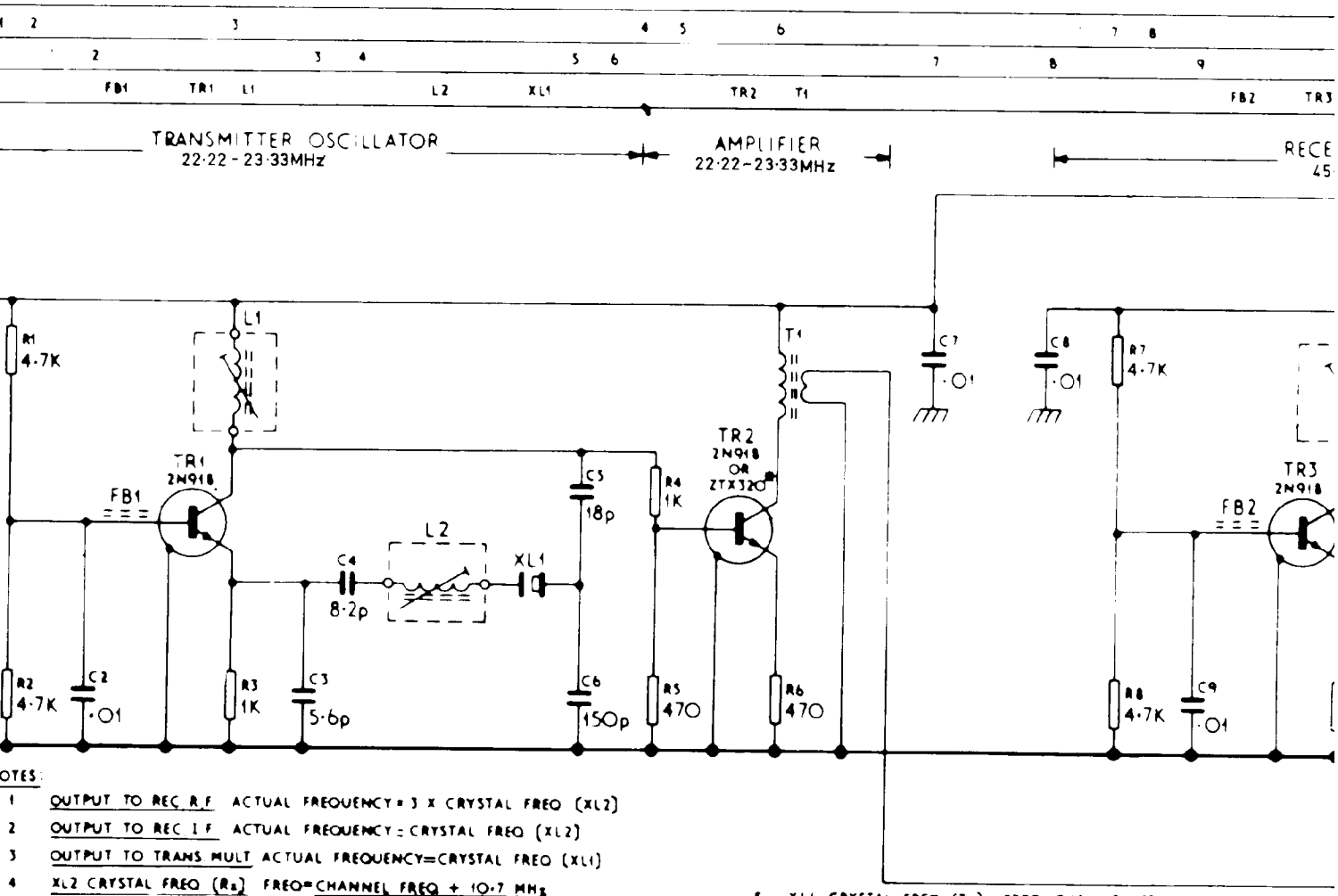


2N2368 TR5 (ALTERNATIVE)
* EARTH CONNEXION ON BOARD
NOT USED

1N4148 D1

BANDS OR SPOT
DENOTE CATHODE





OTES:

1 OUTPUT TO REC R.F. ACTUAL FREQUENCY = 3 X CRYSTAL FREQ (XL2)

2 OUTPUT TO REC I.F. ACTUAL FREQUENCY = CRYSTAL FREQ (XL2)

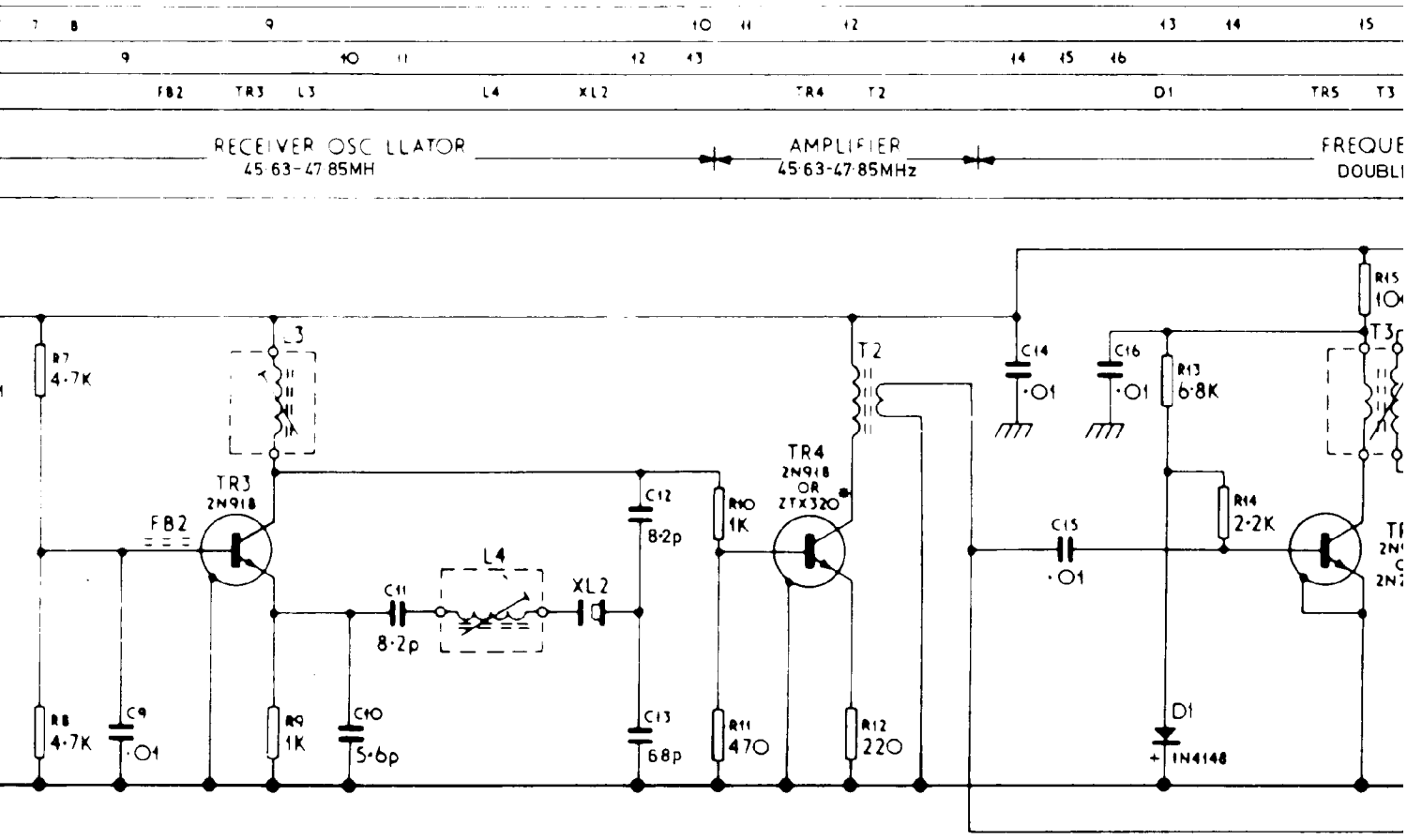
3 OUTPUT TO TRANS MULT ACTUAL FREQUENCY=CRYSTAL FREQ (XL1)

4 XL2 CRYSTAL FREQ (R2) FREQ=$\frac{\text{CHANNEL FREQ} + 10{\cdot}7\ \text{MHz}}{9}$

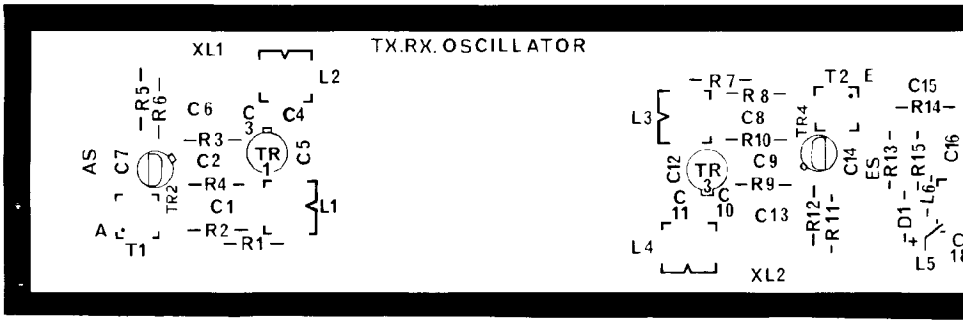
(8 FIGURE SPECIFICATION)
MIN FREQ = 45·633333MHz (CHAN FREQ = 400MHz)
MAX FREQ = 47·855555MHz (CHAN FREQ = 420MHz)

5 XL1 CRYSTAL FREQ (T2) FREQ=$\frac{\text{CHANNEL FREQ}}{18}$ MHz

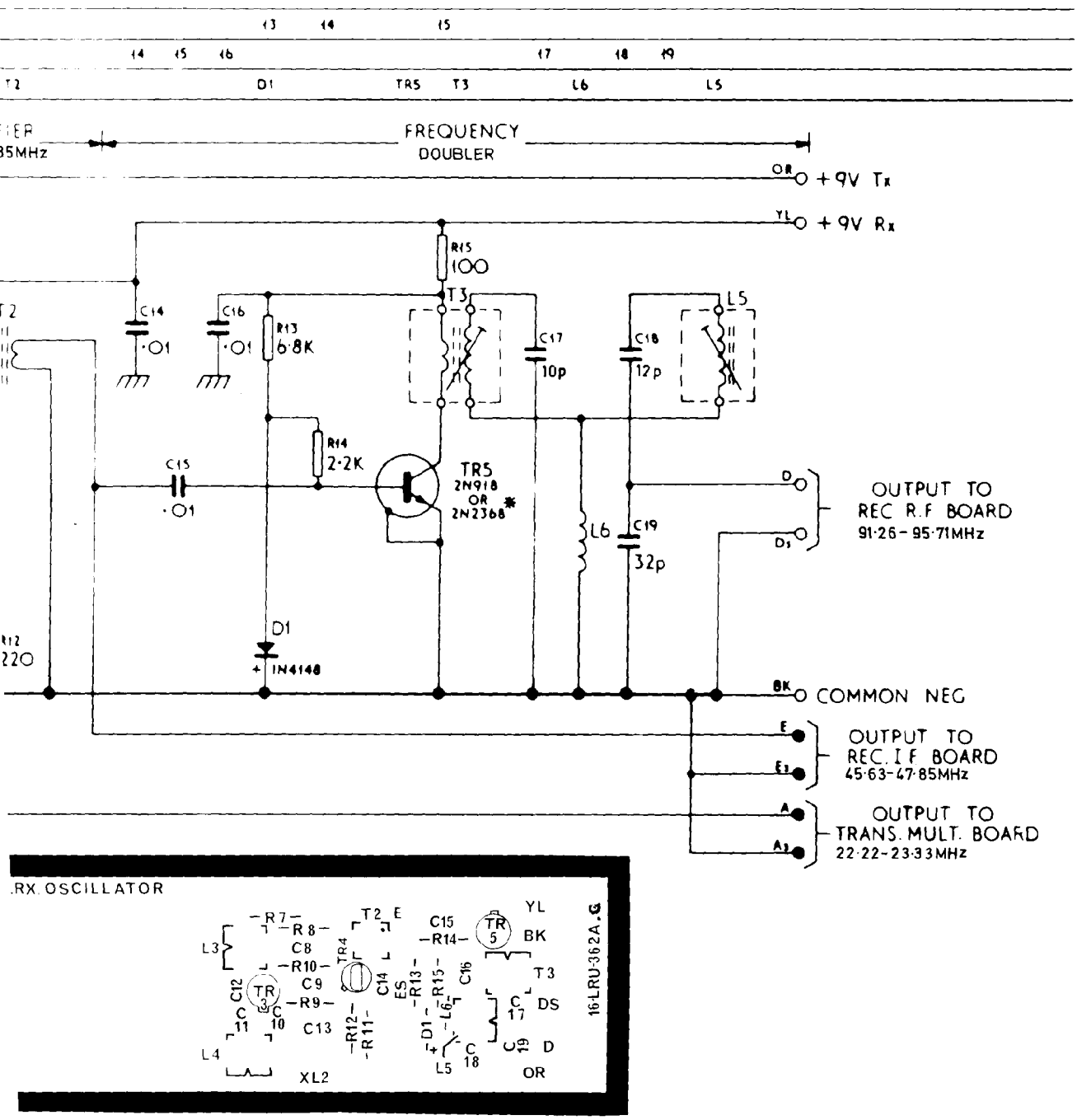
(8 FIGURE SPECIFICATION)
MIN FREQ = 22·222222MHz (CHAN FREQ = 4C
MAX FREQ = 23·333333MHz (CHAN FREQ = 4



ANNEL FREQ MHz
18
RE SPECIFICATION)
2·222222MHz (CHAN FREQ=400MHz)
23·333333MHz (CHAN FREQ=420MHz)



p.c.b. Component Code actual size.

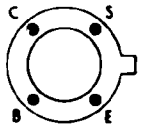


c.b. Component Code actual size.

16-LRU-362AG TRANSMITTER/RECEIVER OSCILLATOR BOARD 400 420MHz BAND

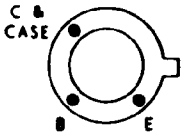
FIG 10

RESISTORS	1 2
CAPACITORS	1 2
MISCELLANEOUS	



2N918 TR1, TR2, TR3, TR4, TR5

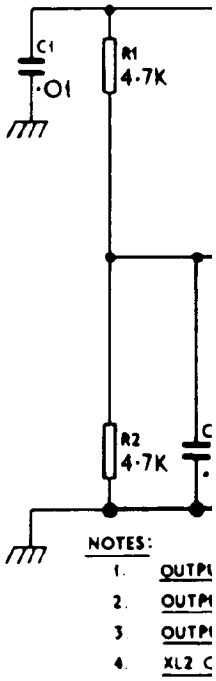
ZTX320 TR2 TR4 (ALTERNATIVES)
* EARTH CONNEXION ON BOARD
NOT USED

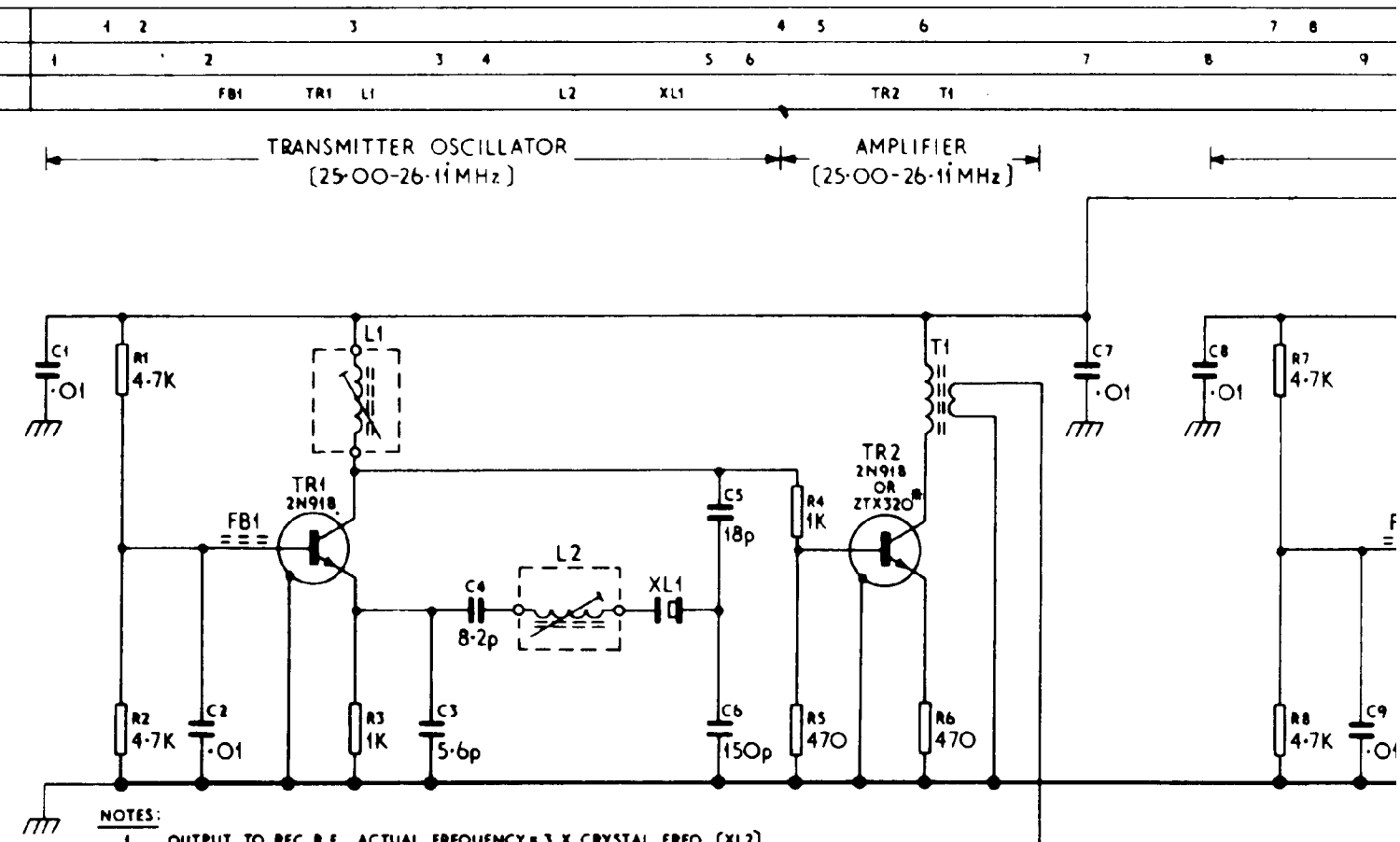


2N2368 TR5 (ALTERNATIVE)
* EARTH CONNEXION ON BOARD
NOT USED

1N4148 D1

BANDS OR SPOT
DENOTE CATHODE





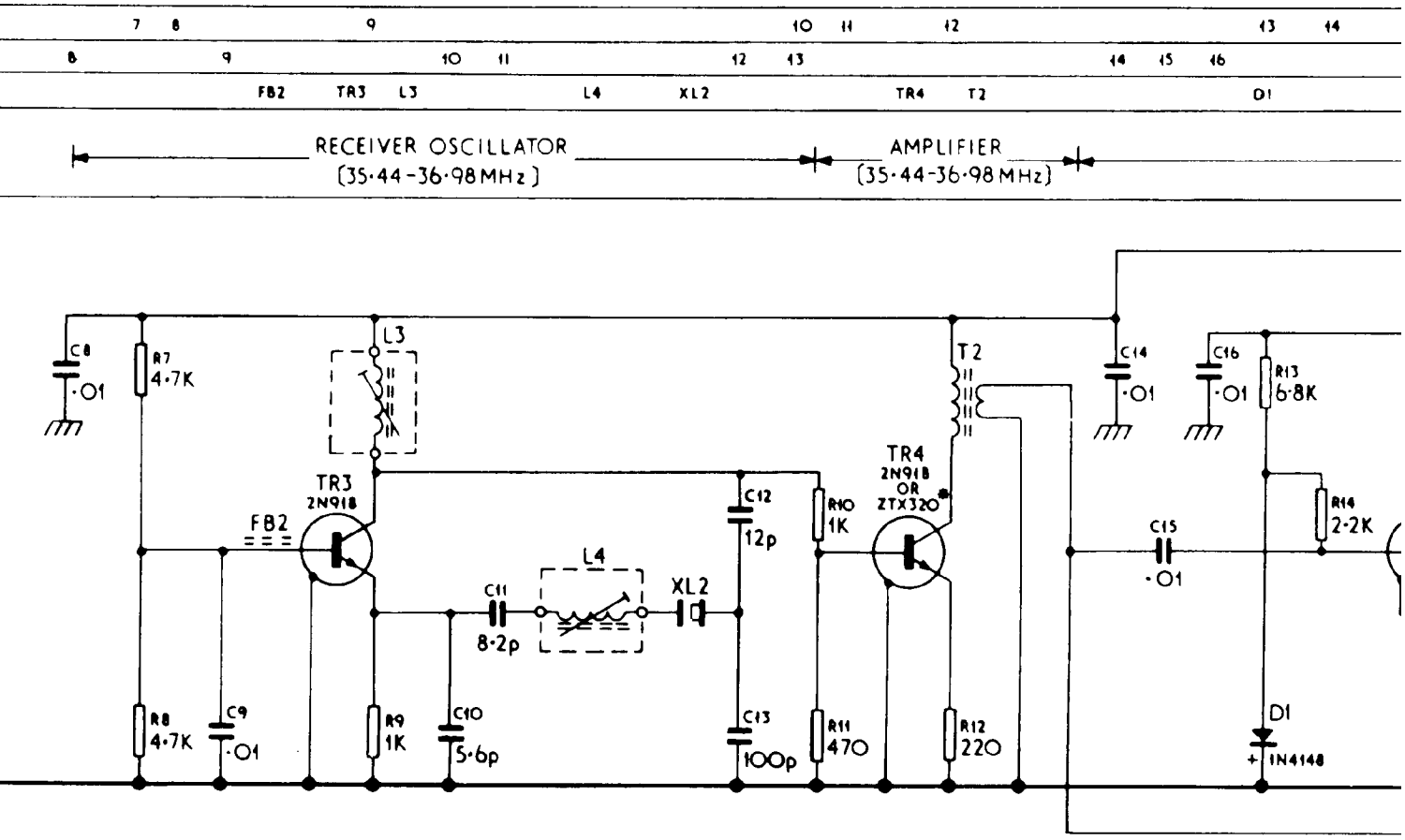
NOTES:

1. OUTPUT TO REC. R.F. ACTUAL FREQUENCY = 3 X CRYSTAL FREQ. (XL2)
2. OUTPUT TO REC. I.F. ACTUAL FREQUENCY = CRYSTAL FREQ. (XL2)
3. OUTPUT TO TRANS. MULT ACTUAL FREQUENCY=CRYSTAL FREQ (XL1)
4. XL2 CRYSTAL FREQ. (R_x) FREQ=$\frac{\text{CHANNEL FREQ + 10·7 MHz}}{13}$

(8 FIGURE SPECIFICATION)
MIN. FREQ=35·438461 MHz (CHAN. FREQ = 450MHz)
MAX. FREQ=36·976923 MHz (CHAN. FREQ = 470MHz)

5. XL1 CRYSTAL FREQ (T_x) FREQ=$\frac{\text{CHANNEL FREQ}}{18}$ MHz

(8 FIGURE SPECIFICATION)
MIN. FREQ = 25·000000 MHz (CHAN. FR
MAX. FREQ.=26·111111 MHz (CHAN. FR

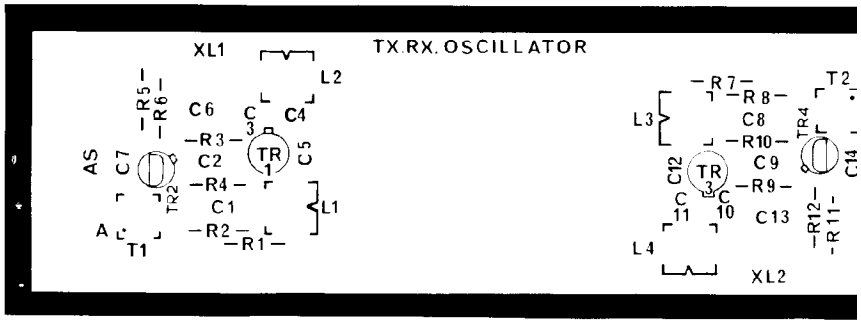


FREQ = CHANNEL FREQ / 18 MHz

(8 FIGURE SPECIFICATION)

= 25·000000 MHz (CHAN. FREQ = 450 MHz)

= 26·111111 MHz (CHAN FREQ = 470 MHz)

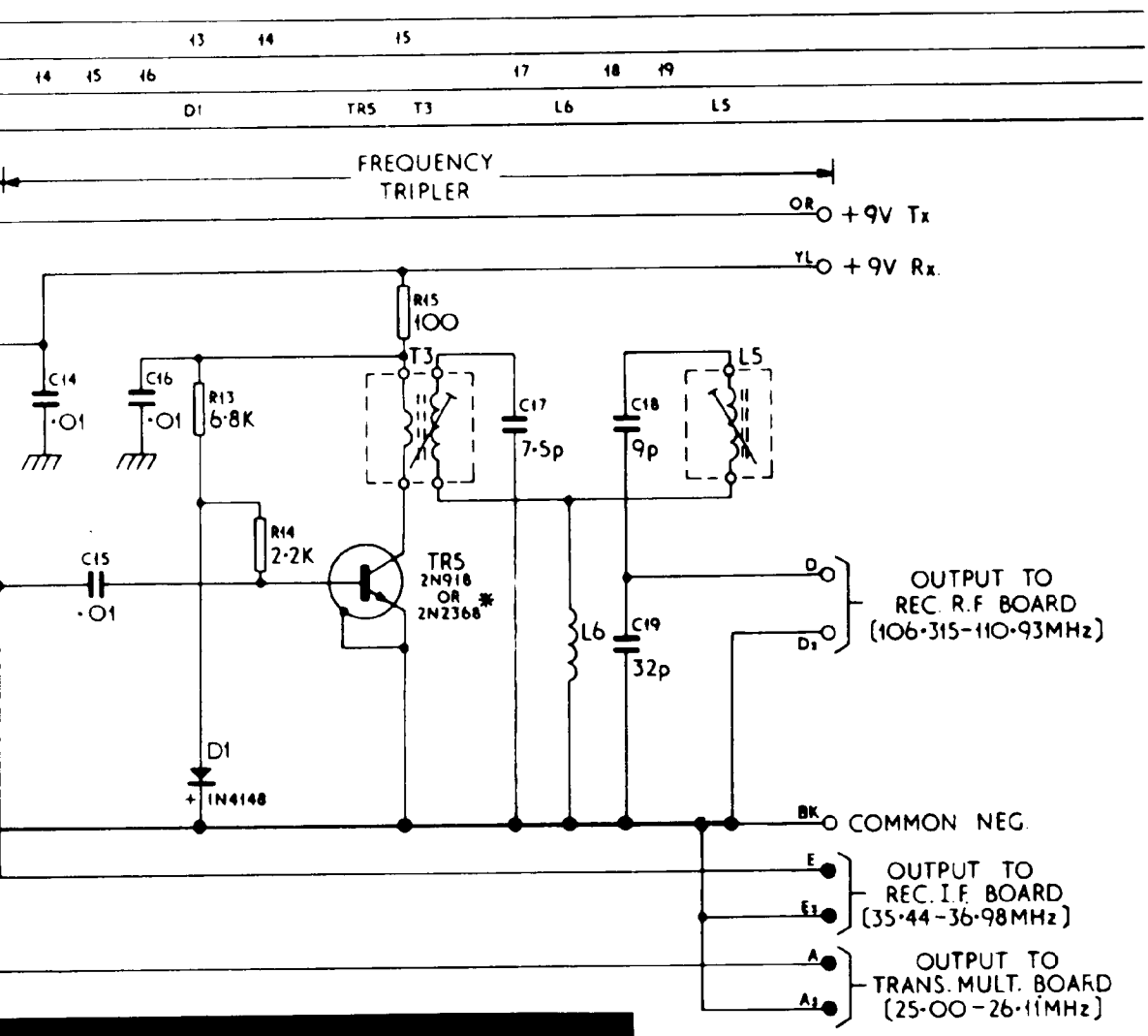


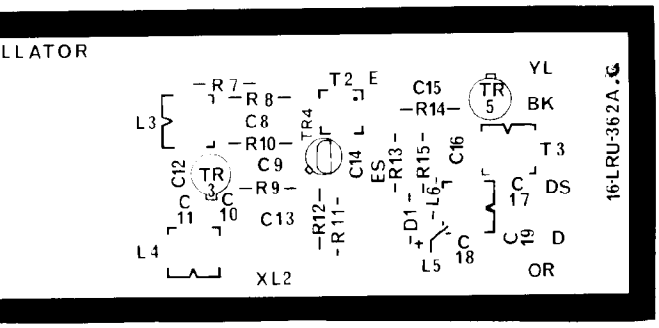
p.c.b. Component Code actual size.

FIG. 11

TRANSMITTER / RECEIVER OSCILLATOR BOARD 342103

16-LRU-362A





nponent Code actual size.

FIG. 11

RESISTORS	
CAPACITORS	
MISCELLANEOUS	

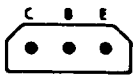
NOTES:

1. OUTPUT TO TRANS. MULT. ACTUAL FREQ. = CRYSTAL FREQ.

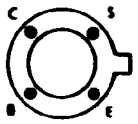
2. CRYSTAL FREQS (XL1, XL2 ETC.). FREQ. = $\frac{\text{CHANNEL FREQ.}}{18}$ MHz
(8 FIGURE SPECIFICATION)

MIN FREQ 22·22222MHz (CHAN FREQ = 400MHz)
MAX FREQ 23·333333MHz (CHAN FREQ = 420MHz)

3. WHEN THE BOARD IS SUPPLIED AS PART OF A 3 CHANNEL EQUIPMENT CHANNELS 4 & 5 OSCILLATOR CIRCUITS ARE NOT FITTED.



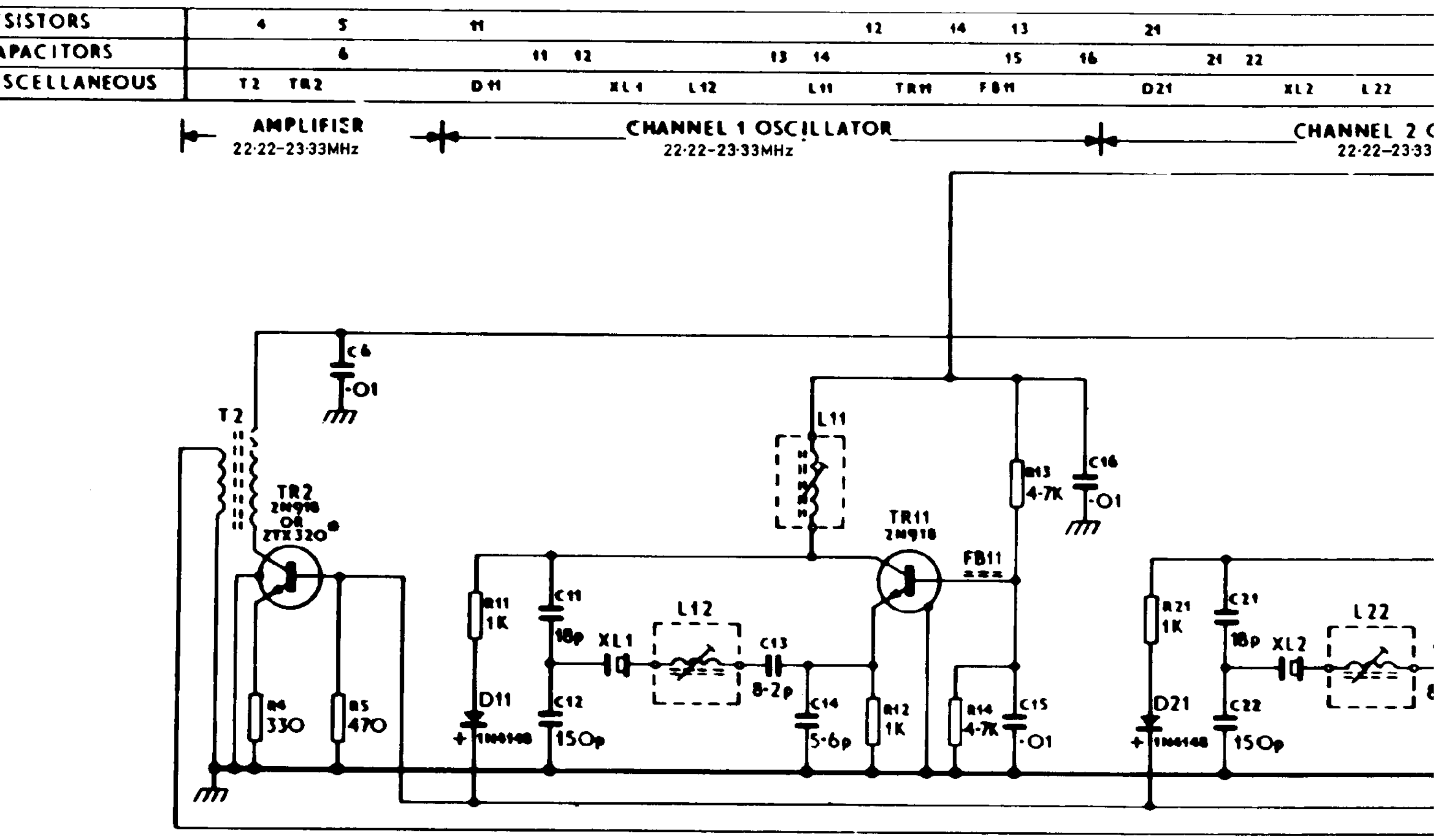
ZTX320 TR2 (ALTERNATIVE)



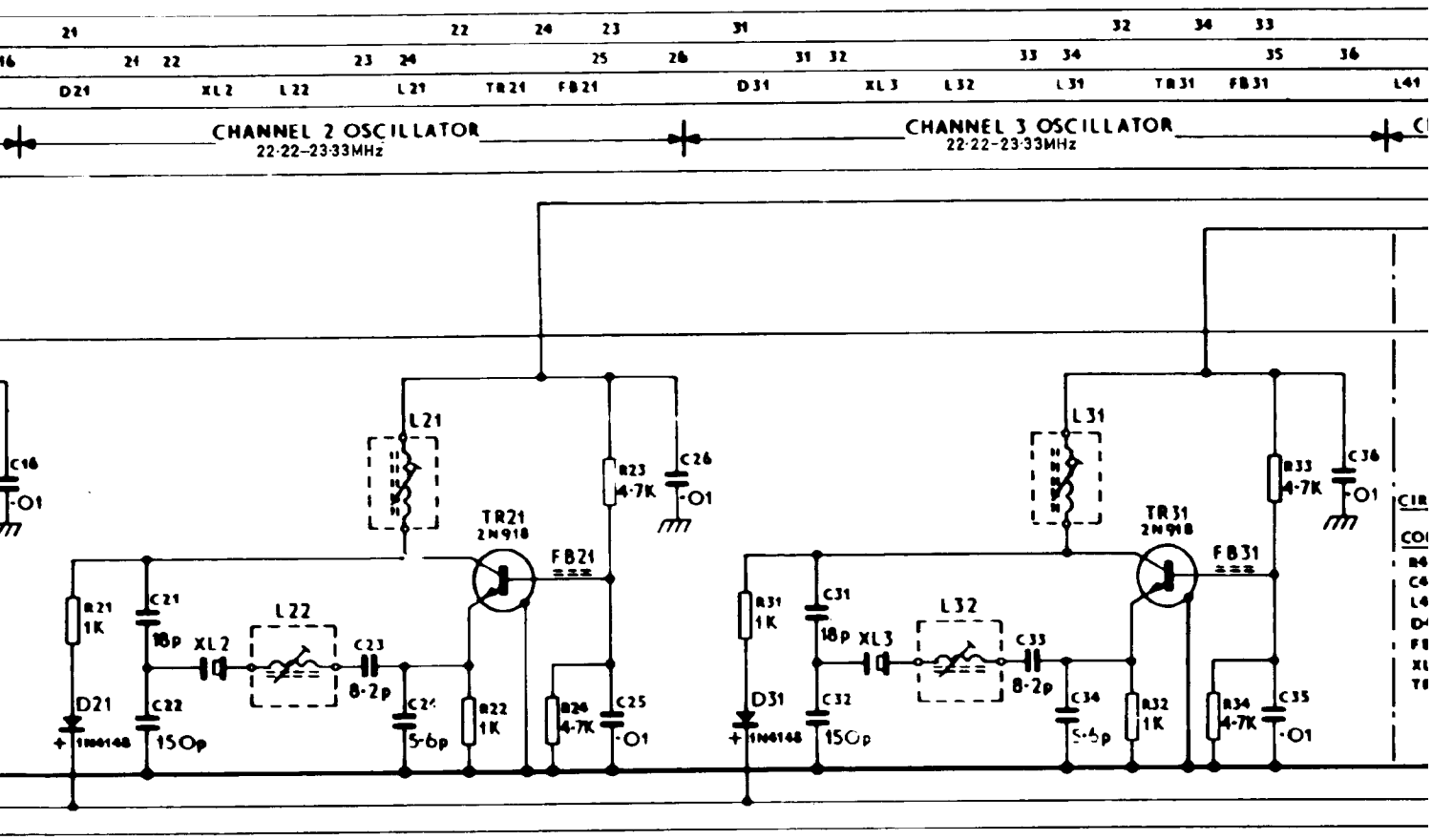
2N918 TR2, TR11, TR21
TR31, TR41, TR51.

BANDS OR RED SPOT DENOTE CATHODE

1N4148 D11, D21, D31, D41, D51.



* NOTE
EARTH CONNEXION ON BOARD NOT USED.



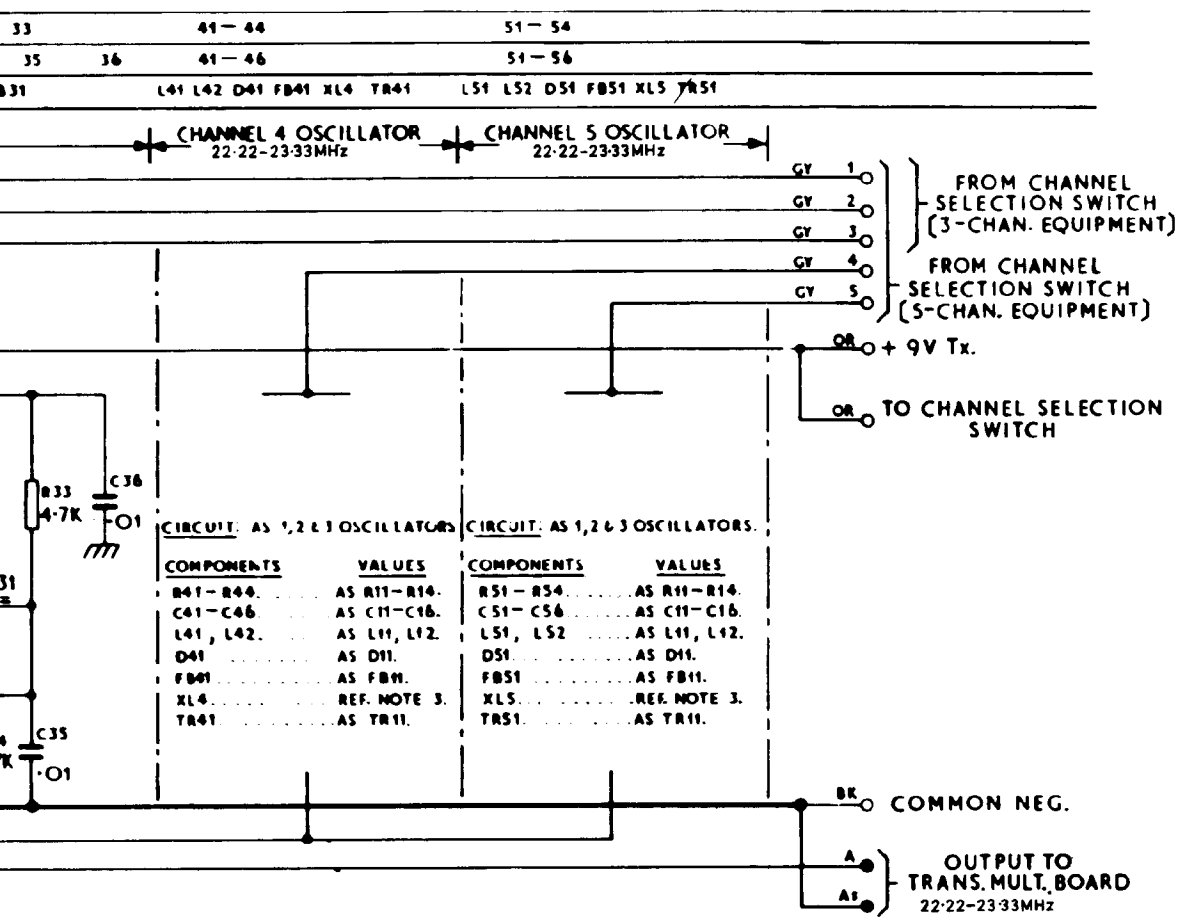


FIG. 12

16 LRU 362BJ TRANSMITTER OSCILLATOR BOARD (3 CHANNEL) 342453
16 LRU 362BL TRANSMITTER OSCILLATOR BOARD (5 CHANNEL) 342454

FIG. 12

RESISTORS	4	5
CAPACITORS		6
MISCELLANEOUS	T2	TR2

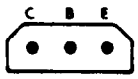
AMPLIFIER (25·00–26·11

NOTES:

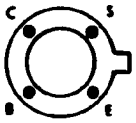
1. OUTPUT TO TRANS. MULT. ACTUAL FREQ. = CRYSTAL FREQ.

2. CRYSTAL FREQS (XL1, XL2 ETC.). FREQ. = $\frac{\text{CHANNEL FREQ.}}{18}$ MHz
(8 FIGURE SPECIFICATION)
MIN. FREQ. = 25·000000 MHz (CHAN. FREQ. = 450 MHz)
MAX. FREQ. = 26·111111 MHz (CHAN. FREQ. = 470 MHz)

3. WHEN THE BOARD IS SUPPLIED AS PART OF A 3 CHANNEL EQUIPMENT CHANNELS 4 & 5 OSCILLATOR CIRCUITS ARE NOT FITTED.



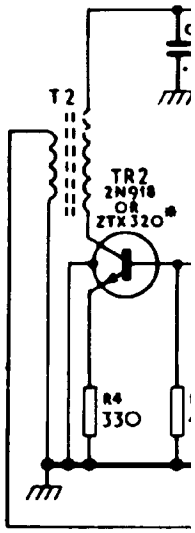
ZTX320 TR2 (ALTERNATIVE)



2N918 TR2, TR11, TR21
TR31, TR41, TR51.

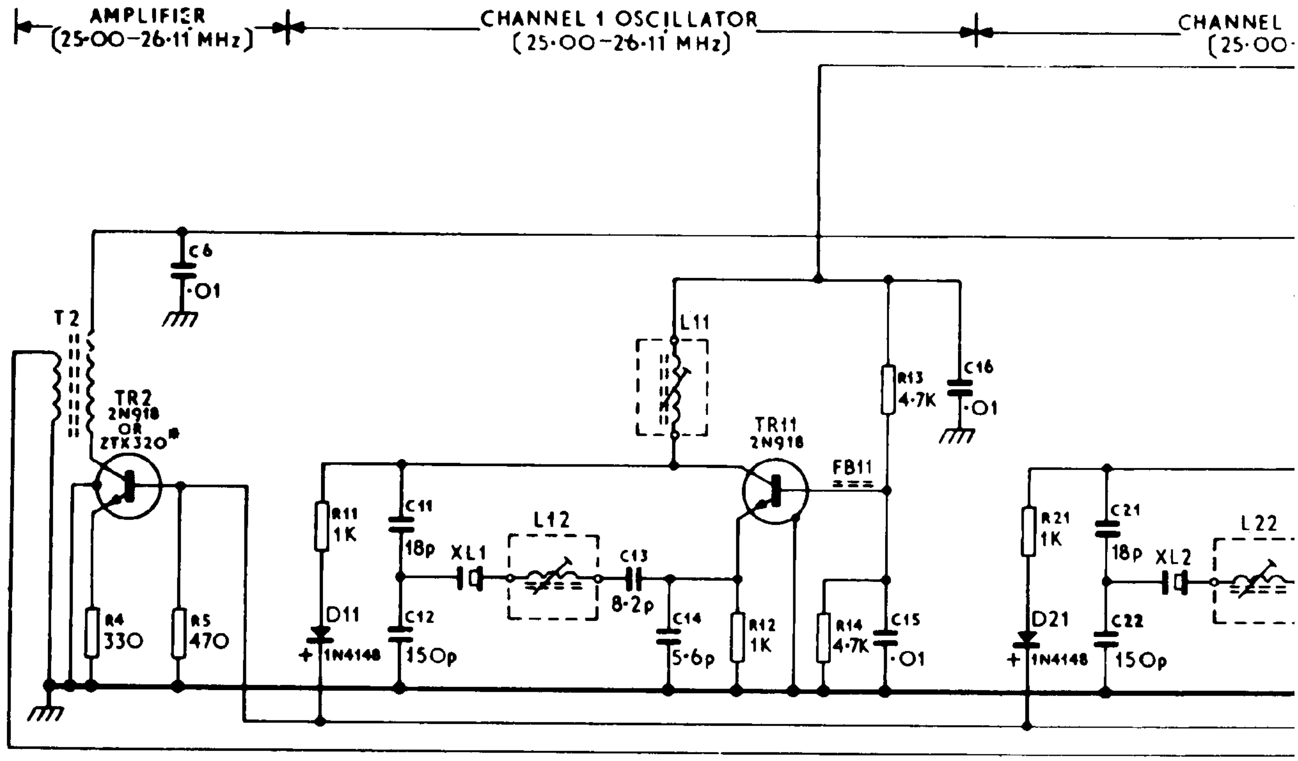
1N4148 D11, D21, D31, D41, D51.

BANDS OR RED SPOT DENOTE CATHODE

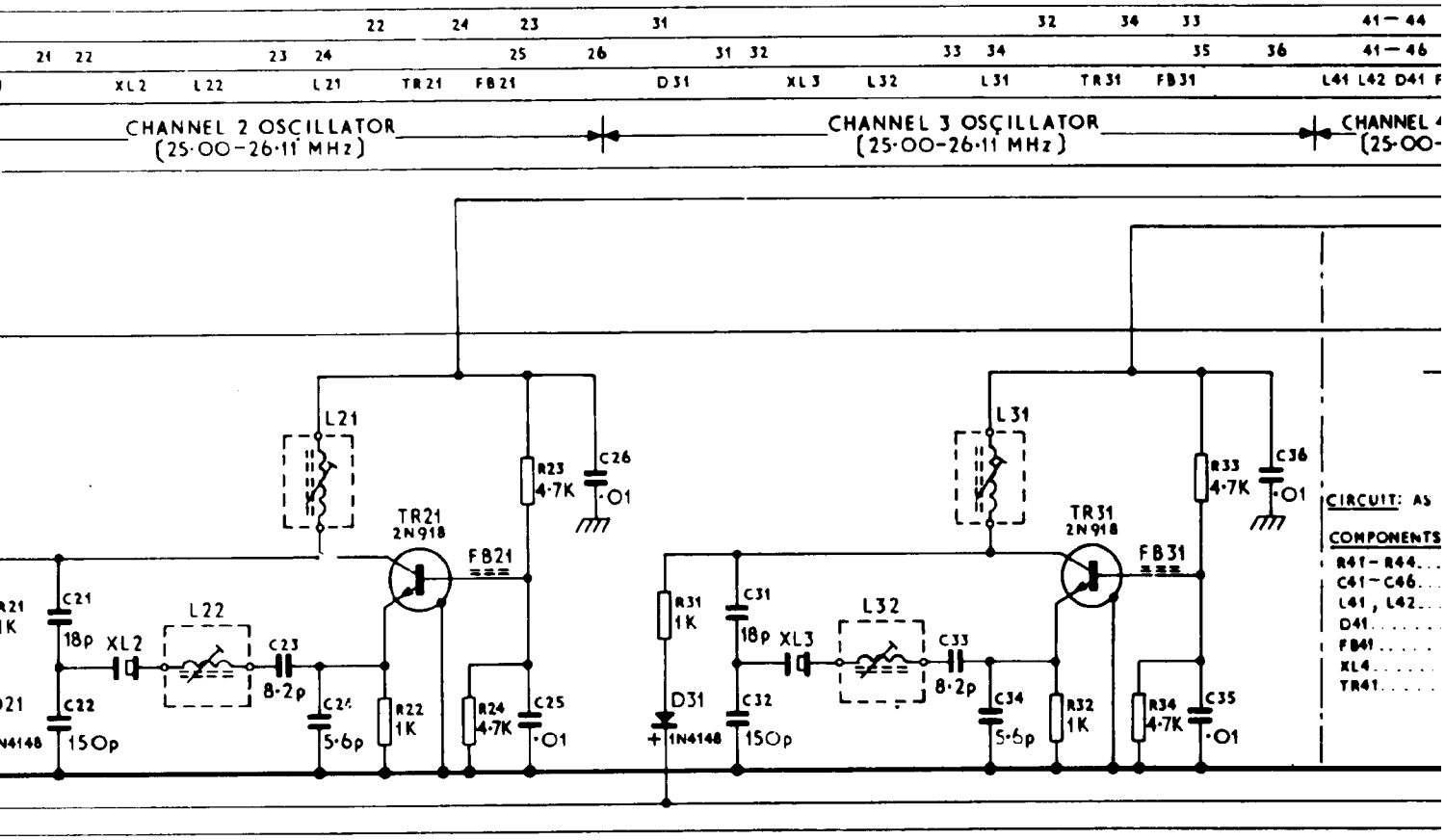


* NOTE
EARTH CONN

RESISTORS	4		5	11							12		14		13		21				
CAPACITORS			6		11	12			13	14					15	16		21	22		
MISCELLANEOUS	T2	TR2		D11			XL1	L12		L11		TR11		FB11			D21			XL2	L22



* NOTE
EARTH CONNEXION ON BOARD NOT USED.



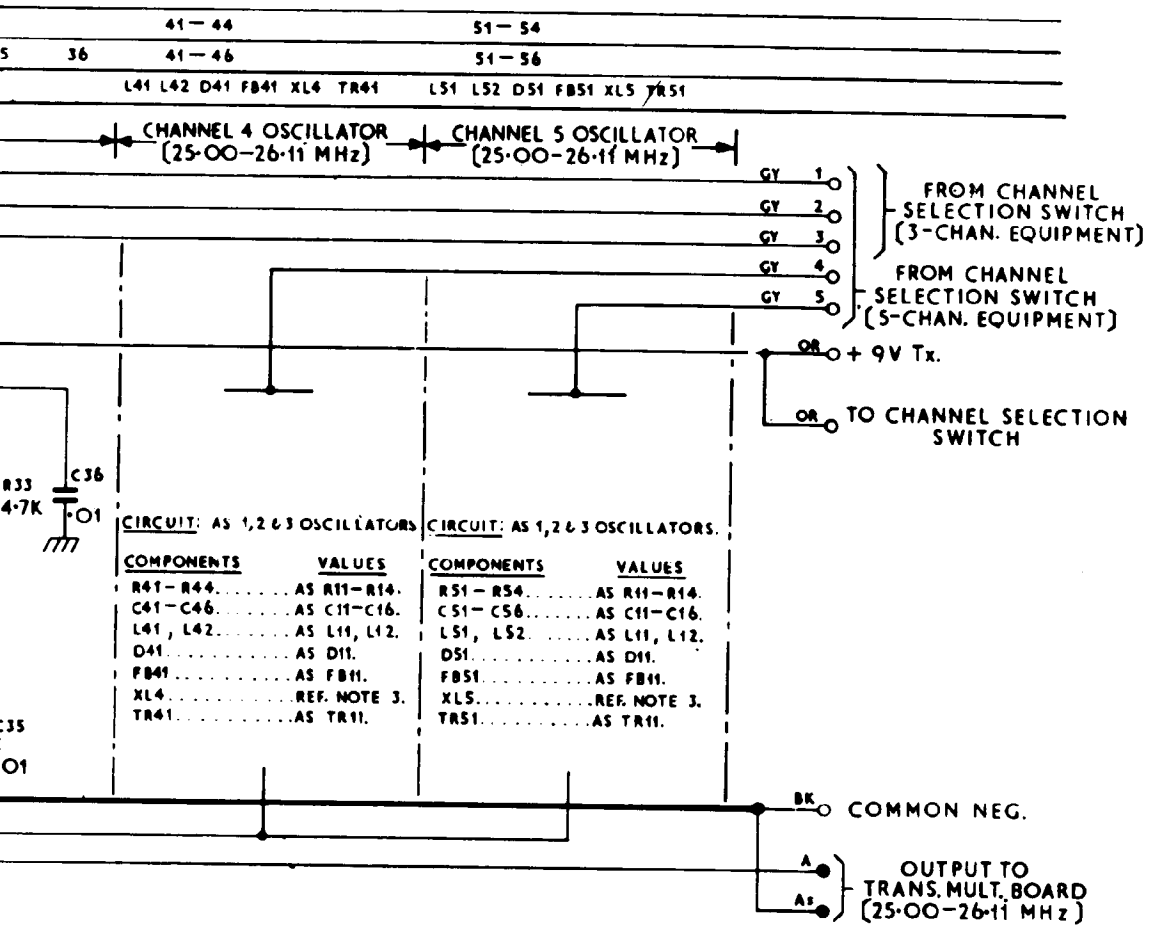


FIG. 13

TRANSMITTER OSCILLATOR BOARD

16-LRU-362 C & E

FIG. 13

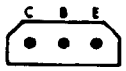
RESISTORS	
CAPACITORS	1 2 3
MISCELLANEOUS	L1 L2 T

FREQ
OU

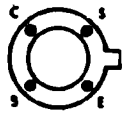
NOTES:

1. OUTPUT TO REC. I.F. ACTUAL FREQ. = CRYSTAL FREQ.
2. OUTPUT TO REC. R.F. ACTUAL FREQ. = 2 X CRYSTAL FREQ.
3. CRYSTAL FREQS. (X1, X2 ETC.) FREQ. = $\frac{\text{CHANNEL FREQ.} + 10{\cdot}7}{9}$ MHz

(8 FIGURE SPECIFICATION)
MIN. FREQ. = 45·633333MHz (CHAN. FREQ. = 400MHz)
MAX. FREQ. = 47·855555MHz (CHAN. FREQ. = 420MHz)

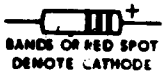


ZTX320 TR2 (ALTERNATIVE)

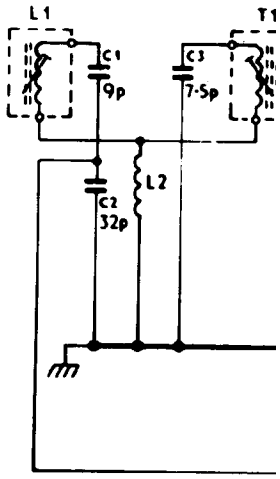


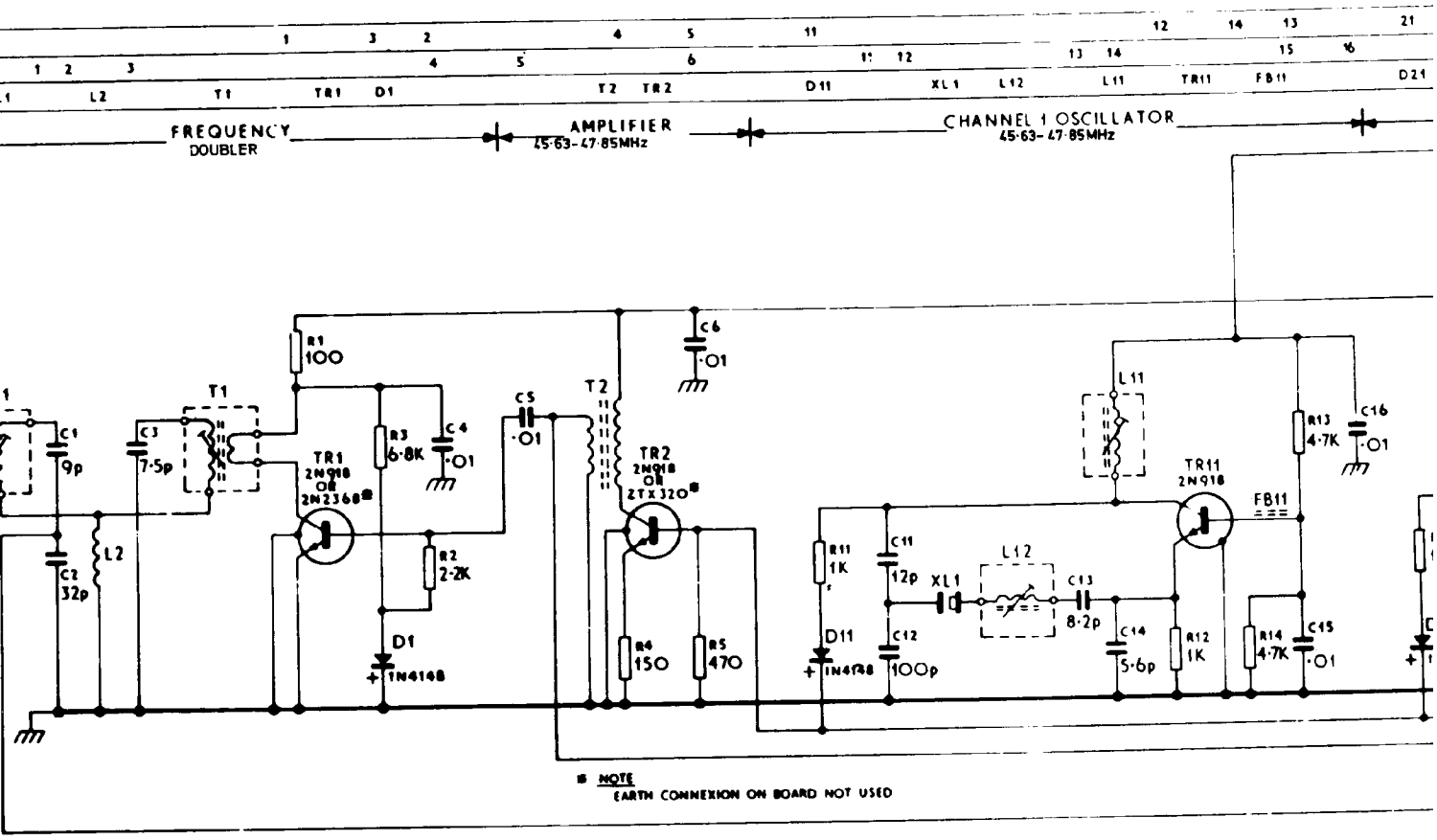
2N918 TR1, TR2, TR11, TR21, TR31, TR41, TR51.

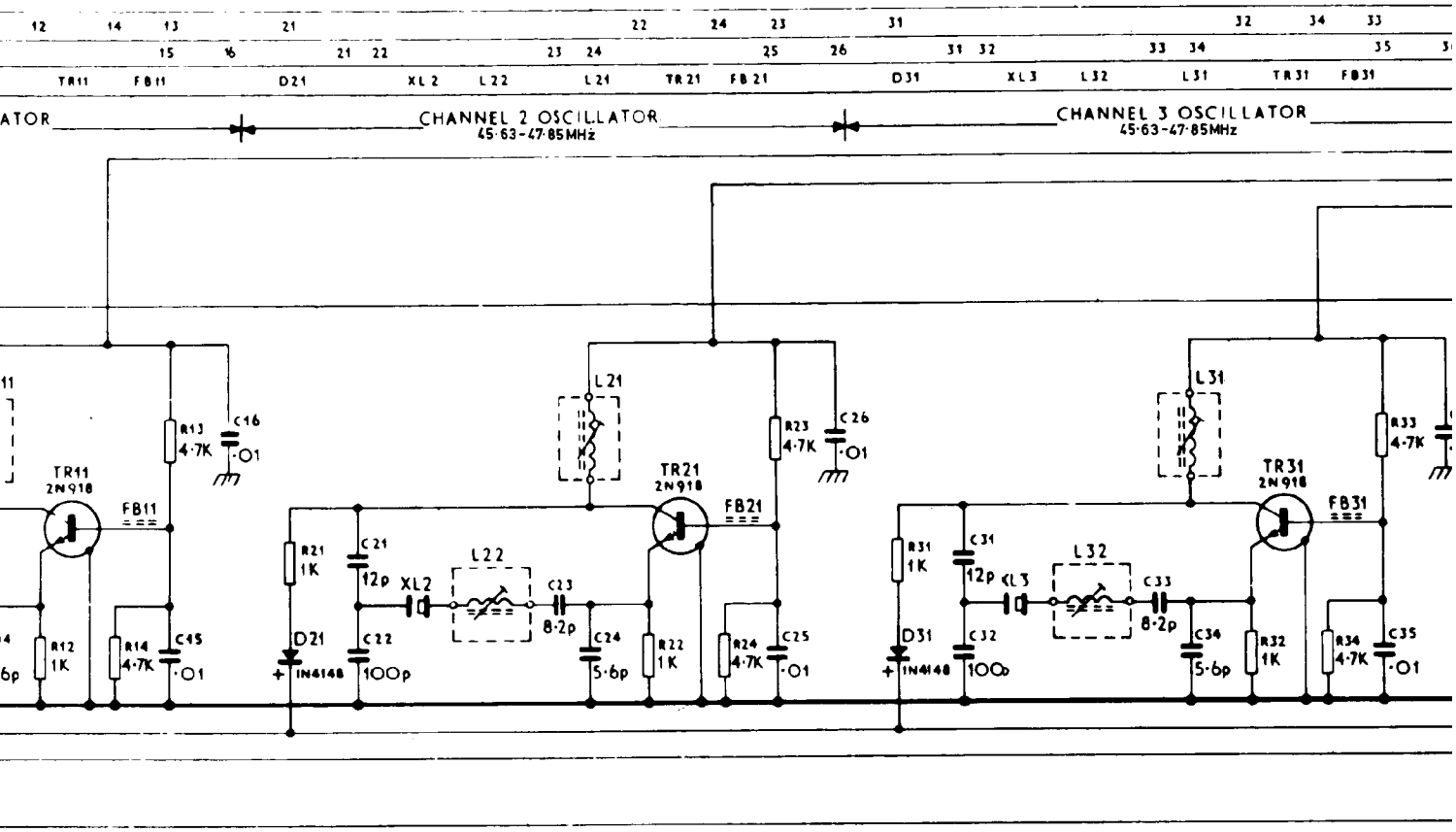
2N2368 TR1 (ALTERNATIVE)



D1,
1N4148 D11, D21, D31, D41, D51.







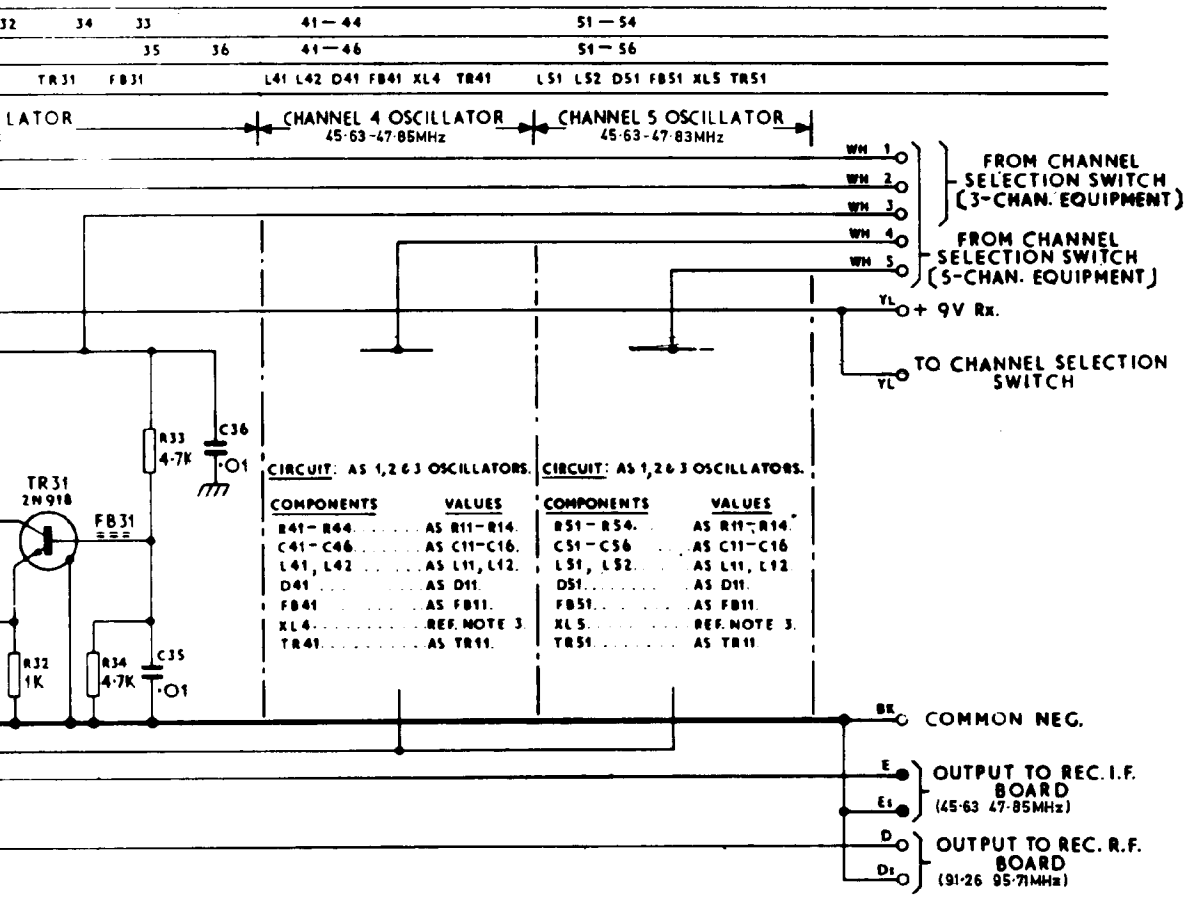


FIG. 14

342455 342456

16-LRU-362BK RECEIVER OSCILLATOR BOARD (3 CHANNEL)
16-LRU-362BM RECEIVER OSCILLATOR BOARD (5 CHANNEL)

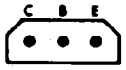
FIG 14

RESISTORS	
CAPACITORS	1 2 3
MISCELLANEOUS	L1 L2

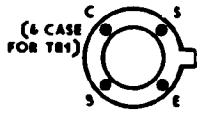
FR
T

NOTES:

1. OUTPUT TO REC. I.F. ACTUAL FREQ. = CRYSTAL FREQ.
2. OUTPUT TO REC. R.F. ACTUAL FREQ. = 3 X CRYSTAL FREQ.
3. CRYSTAL FREQS. (XL1, XL2 ETC.) FREQ. = $\frac{\text{CHANNEL FREQ.} + 10{\cdot}7}{13}$ MHz
   (8 FIGURE SPECIFICATION)
   MIN. FREQ. = 35·438461 MHz (CHAN. FREQ. = 450 MHz)
   MAX. FREQ. = 36·976923 MHz (CHAN. FREQ. = 470 MHz)
4. WHEN THE BOARD IS SUPPLIED AS PART OF A 3 CHANNEL EQUIPMENT CHANNELS 4 & 5 OSCILLATOR CIRCUITS ARE NOT FITTED.



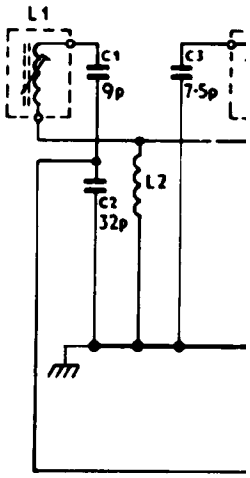
ZTX320 TR2 (ALTERNATIVE)

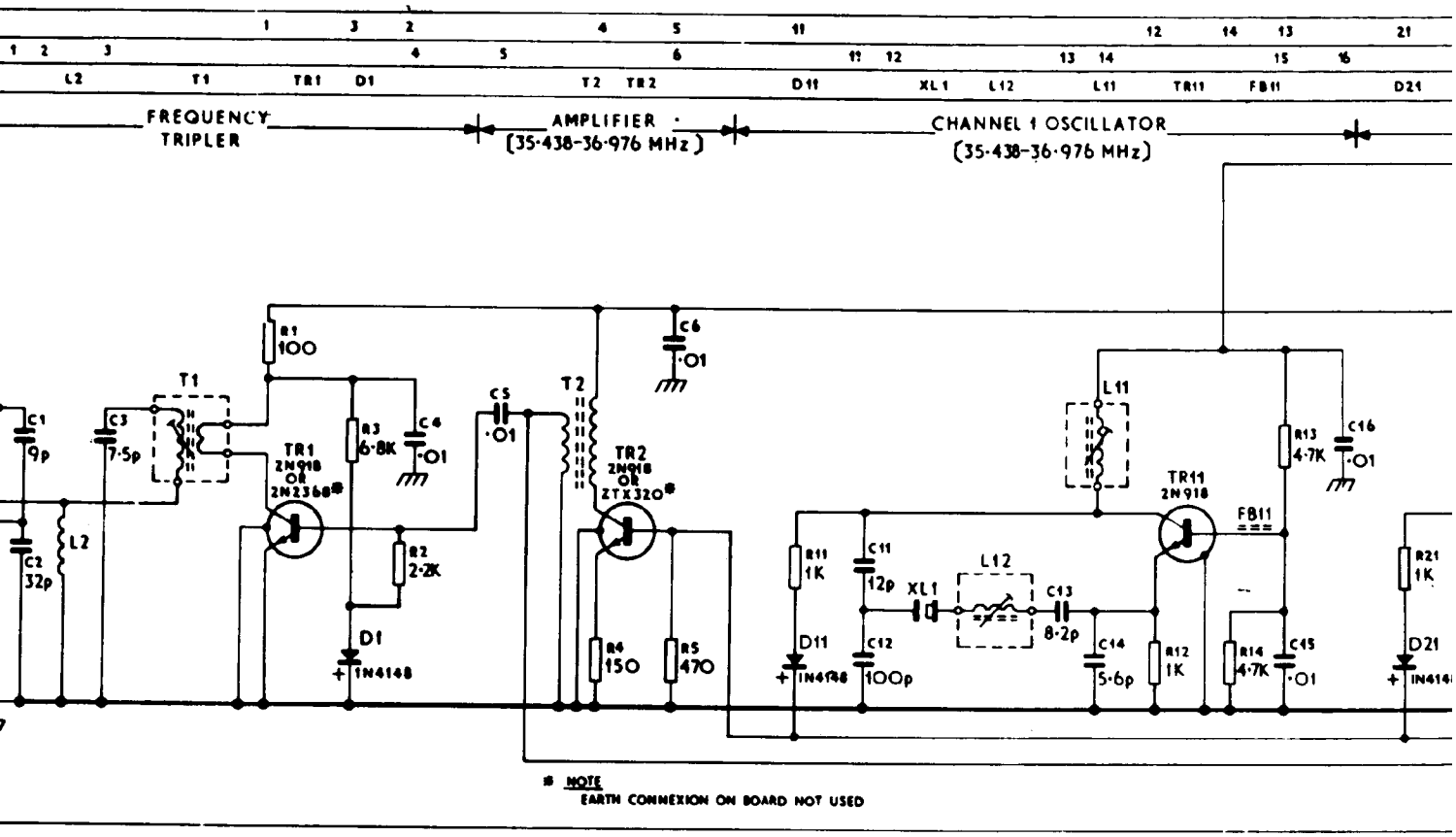


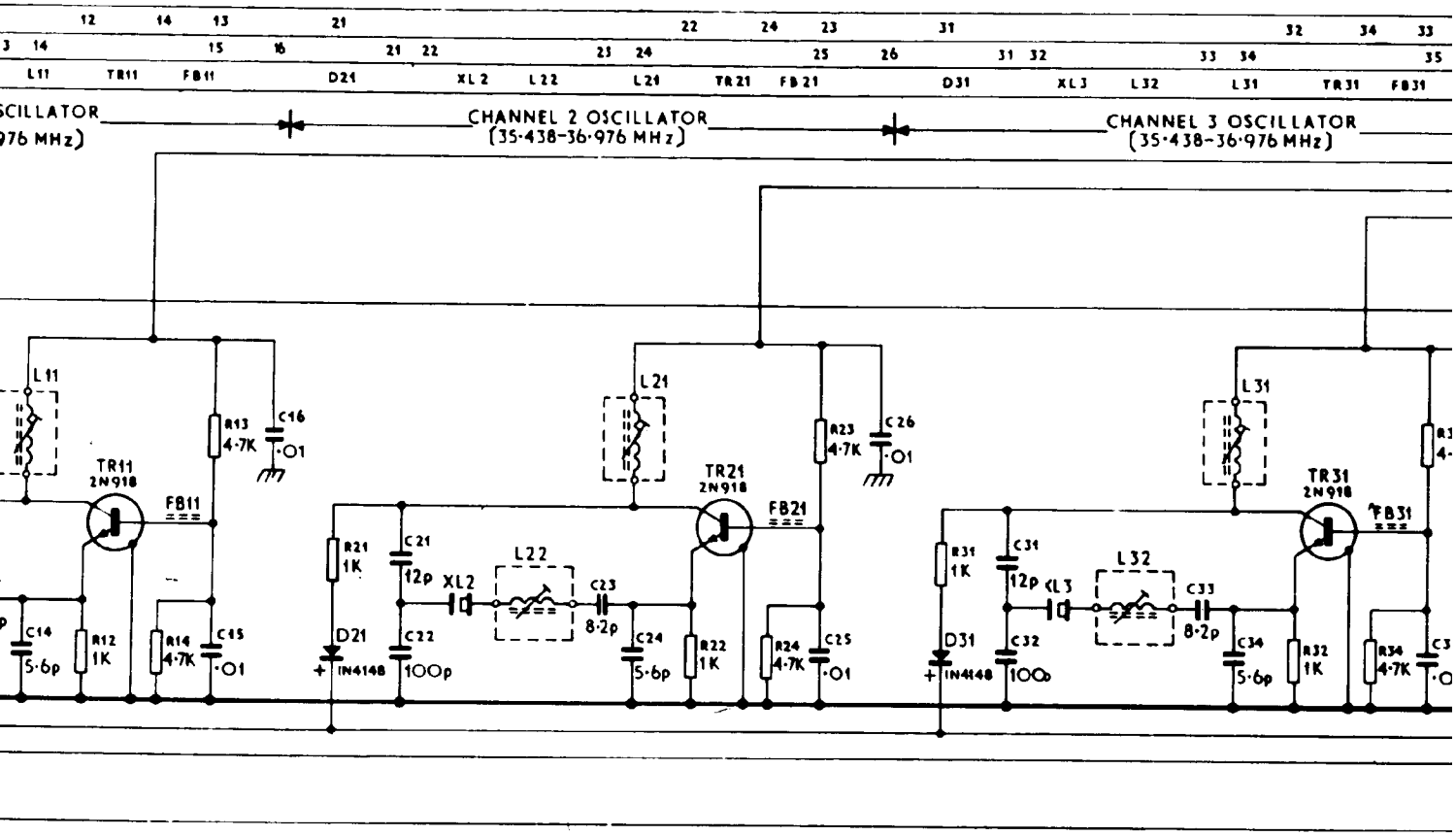
2N918 TR1, TR2, TR11, TR21, TR31, TR41, TR51.

2N2368 TR1 (ALTERNATIVE)

D1, 1N4148 D11, D21, D31, D41, D51.







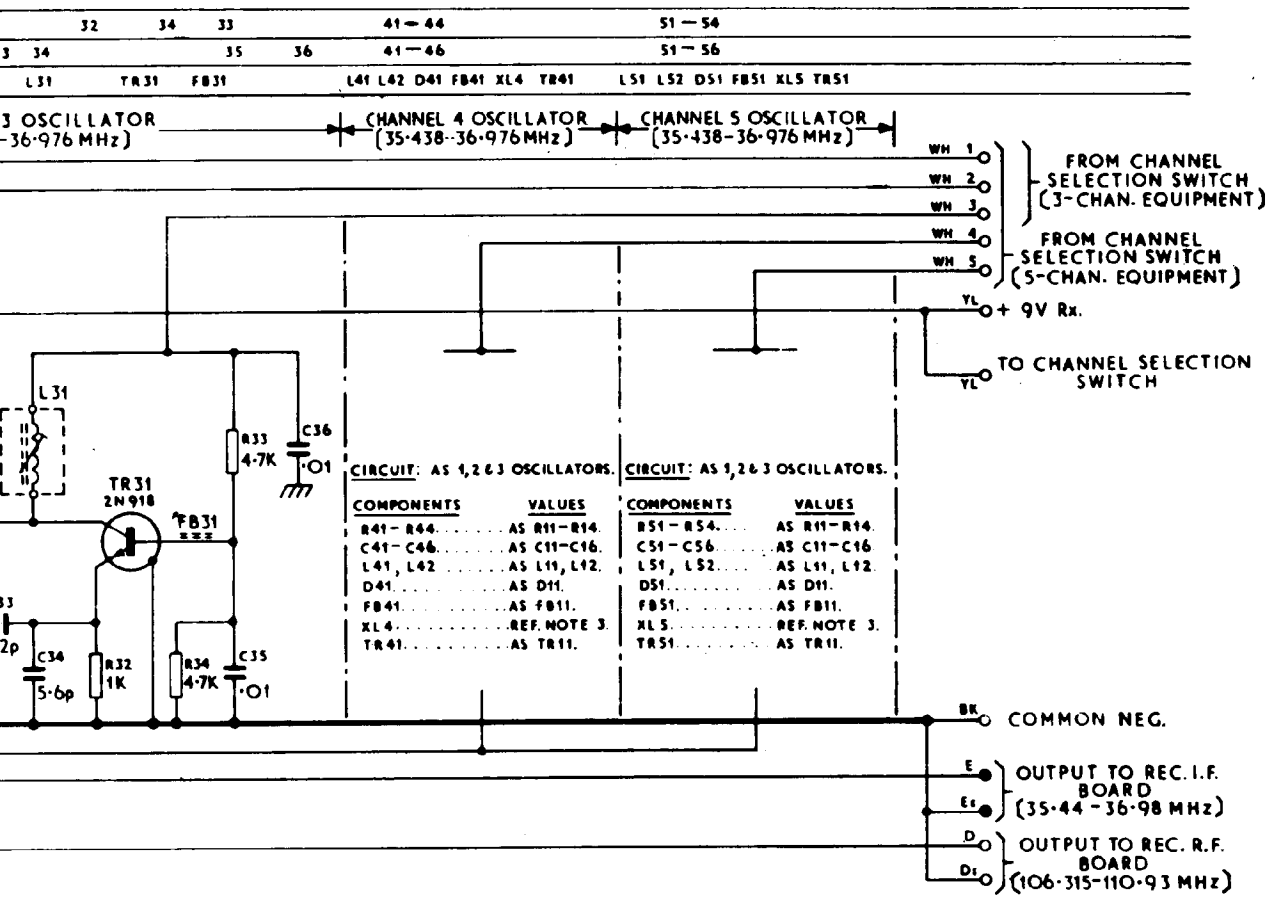


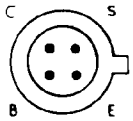
FIG. 15

RECEIVER OSCILLATOR BOARD

16-LRU-362 D & F

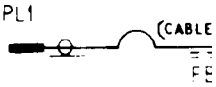
FIG. 15

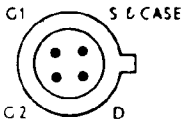
RESISTORS	
CAPACITORS	
MISCELLANEOUS	PL 1 FBS



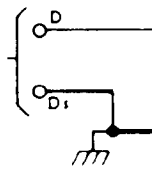
BF180, 2N918, 2N3478
TR1, TR3 & TR4

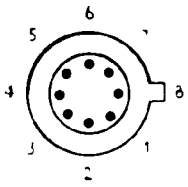
INPUT FROM
TRANS. OUTPUT BOARD
400-420MHz





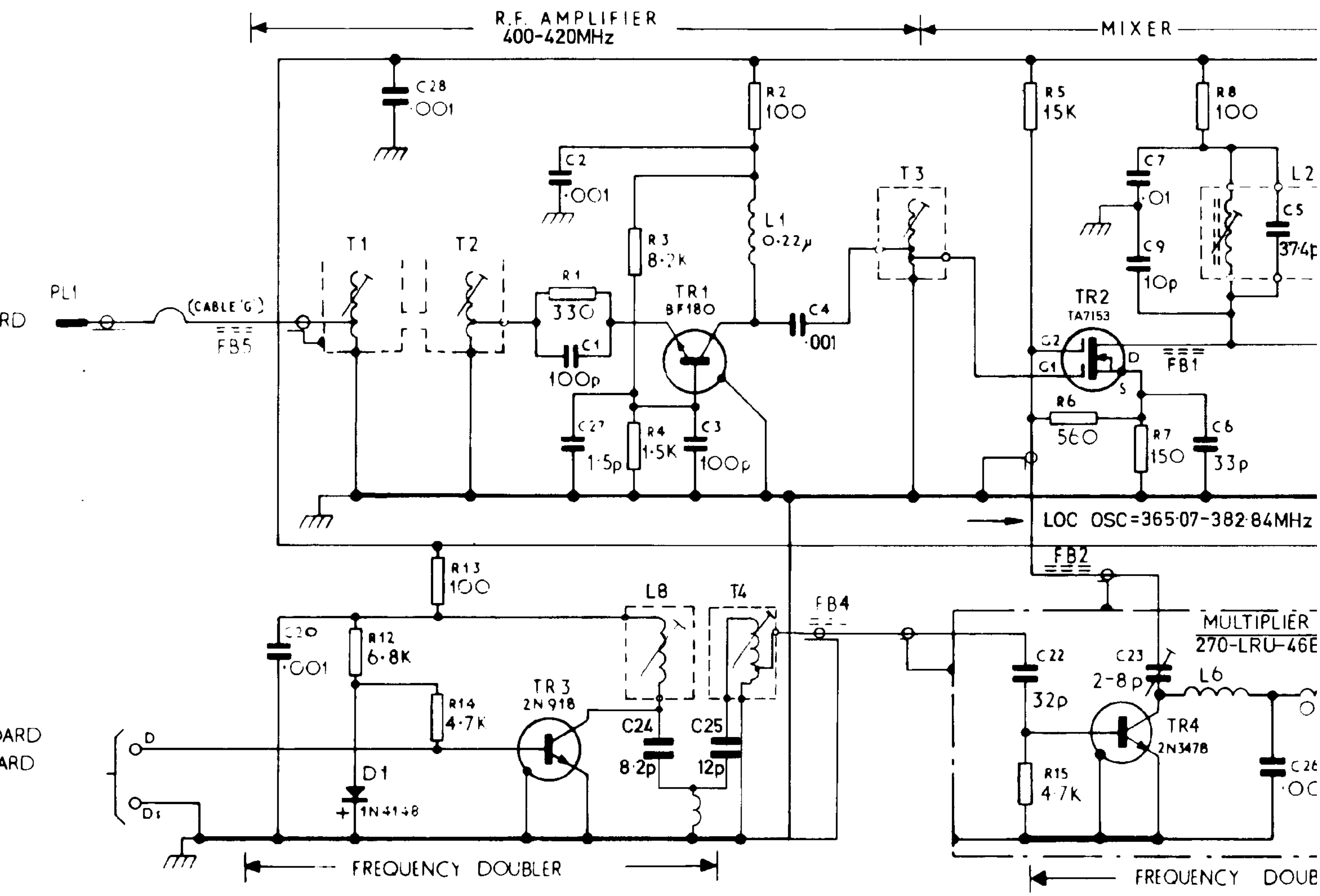
INPUT FROM
TRANS/ REC OSC. BOARD
OR REC OSC BOARD
91·26-95·71MHz

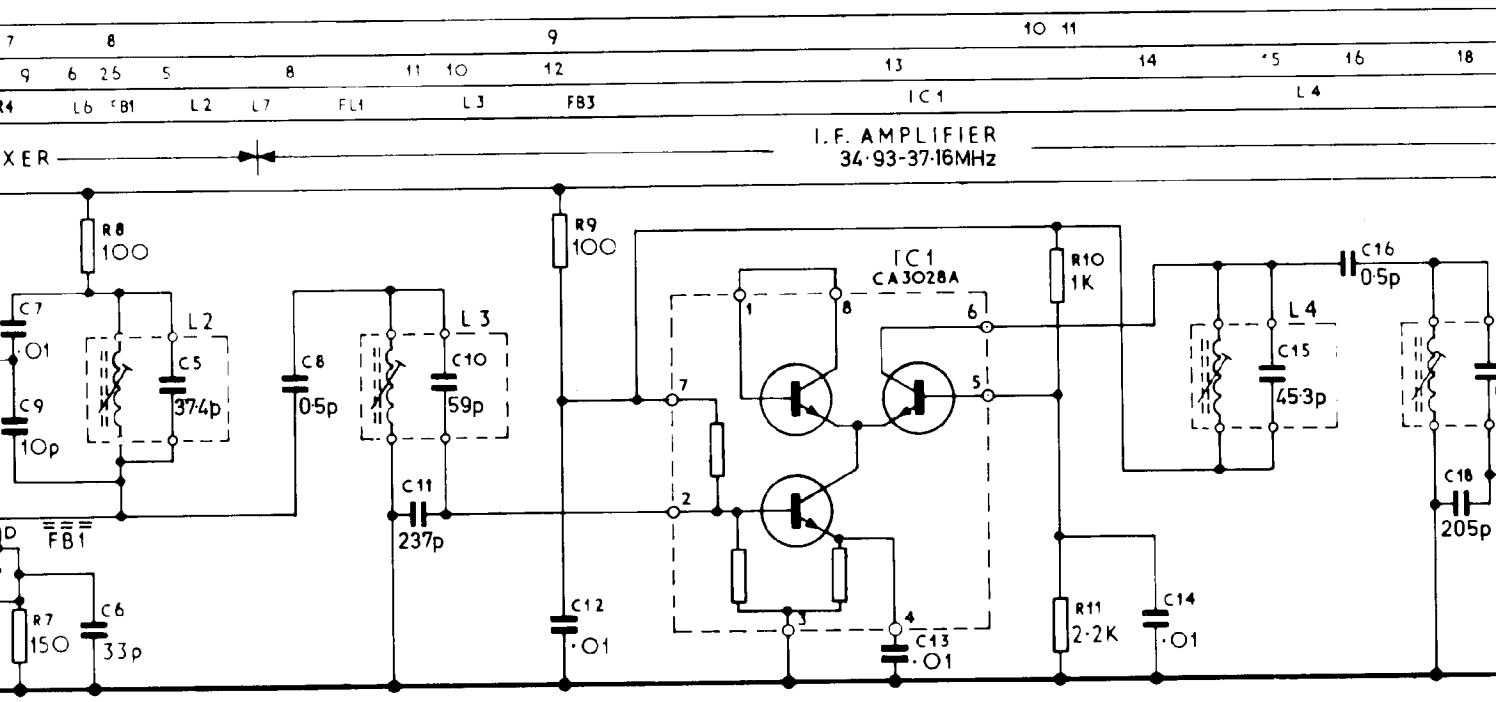




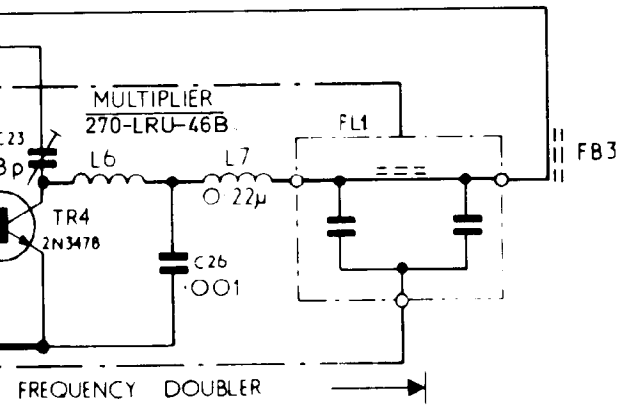
CA3028A
IC1

RS	12 13 14 1 3 4 2 5 15 6 7 8
TORS	20 28 2 1 27 24 25 3 4 22 23 7 9 6 26 5
ANEOUS	PL1 FB5 T1 D1 T2 TR3 T4 TR1 L1 FB4 T3 FB2 TR2 TR4 L6 FB1 L2





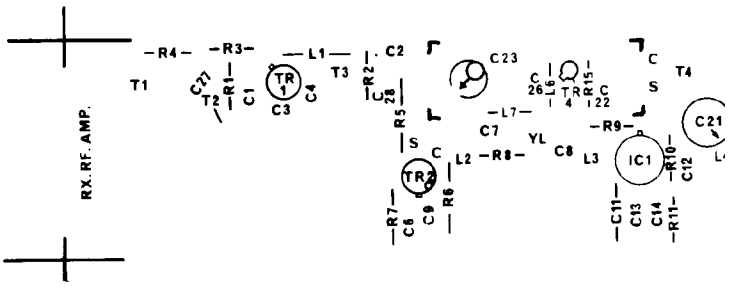
C=365·07-382·84MHz



NOTES:

1. LOC. OSC. ACTUAL FREQ. = $\frac{8}{9}$ (CHANNEL FREQ. + 10·
2. I.F. OUTPUT ACTUAL FREQ. = (CHANNEL FREQ. − LOC. O

p.c.b. Component Code actual size.



$\frac{8}{9}$ (CHANNEL FREQ. + 10·7) MHz.

= (CHANNEL FREQ. − LOC. OSC.) MHz.

actual size.

FIG.
16

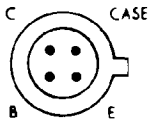
342437

RECEIVER R.F. BOARD 400 420MHz

28-LRU-791E

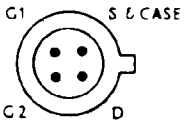
FIG
16

RESISTORS	
CAPACITORS	
MISCELLANEOUS	PL 1 FB5



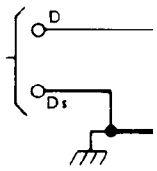
BF180, 2N918, 2N3478
TR1, TR3 & TR4

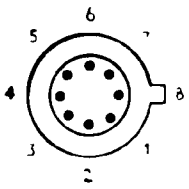
INPUT FROM
TRANS. OUTPUT BOARD
450-470 MHz



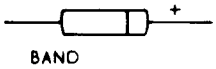
TA7153 BF528
TR2

INPUT FROM
TRANS/ REC. OSC. BOARD
OR REC OSC. BOARD
106·315-110·93 MHz
(LOC. OSC.)

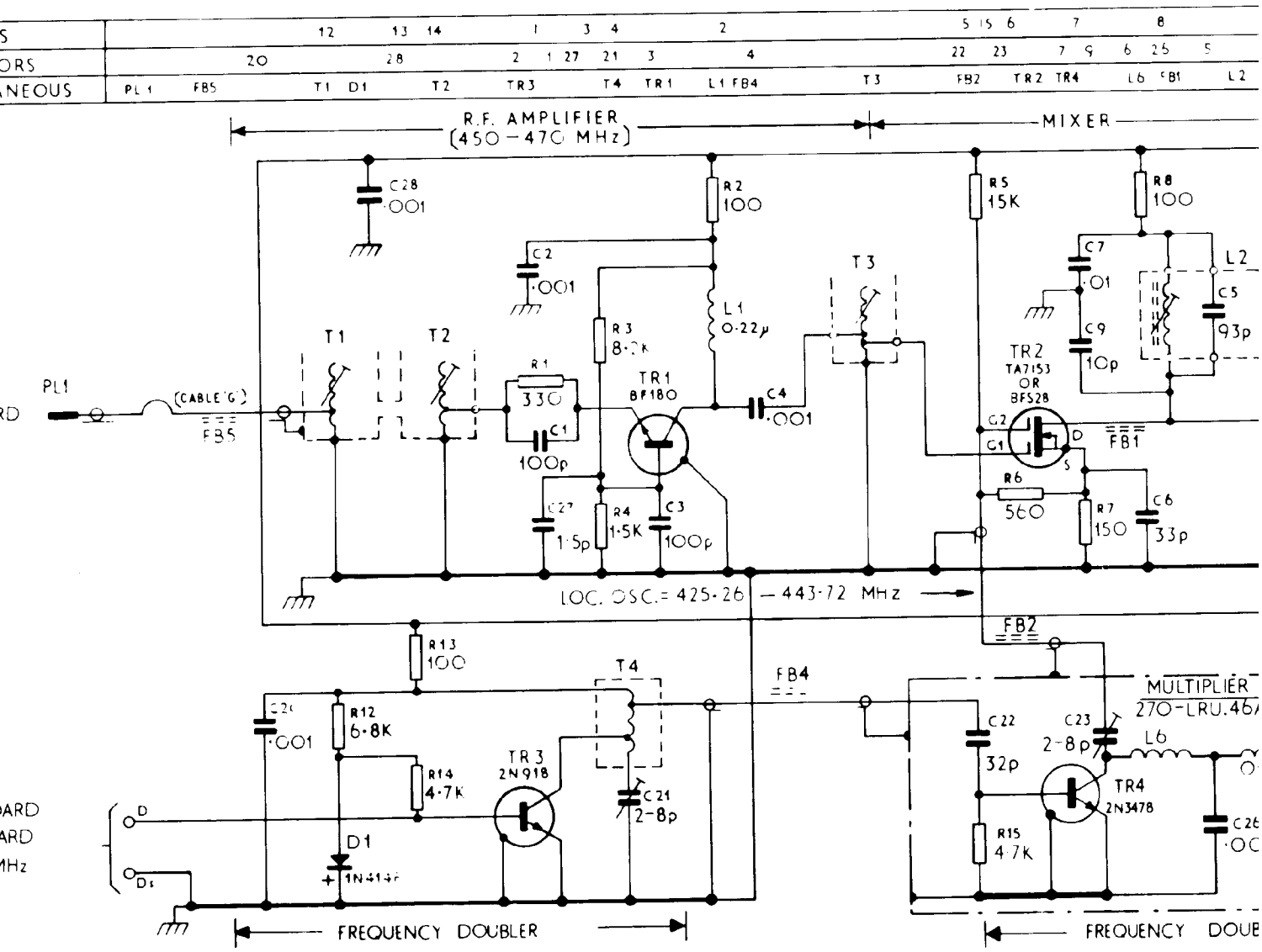


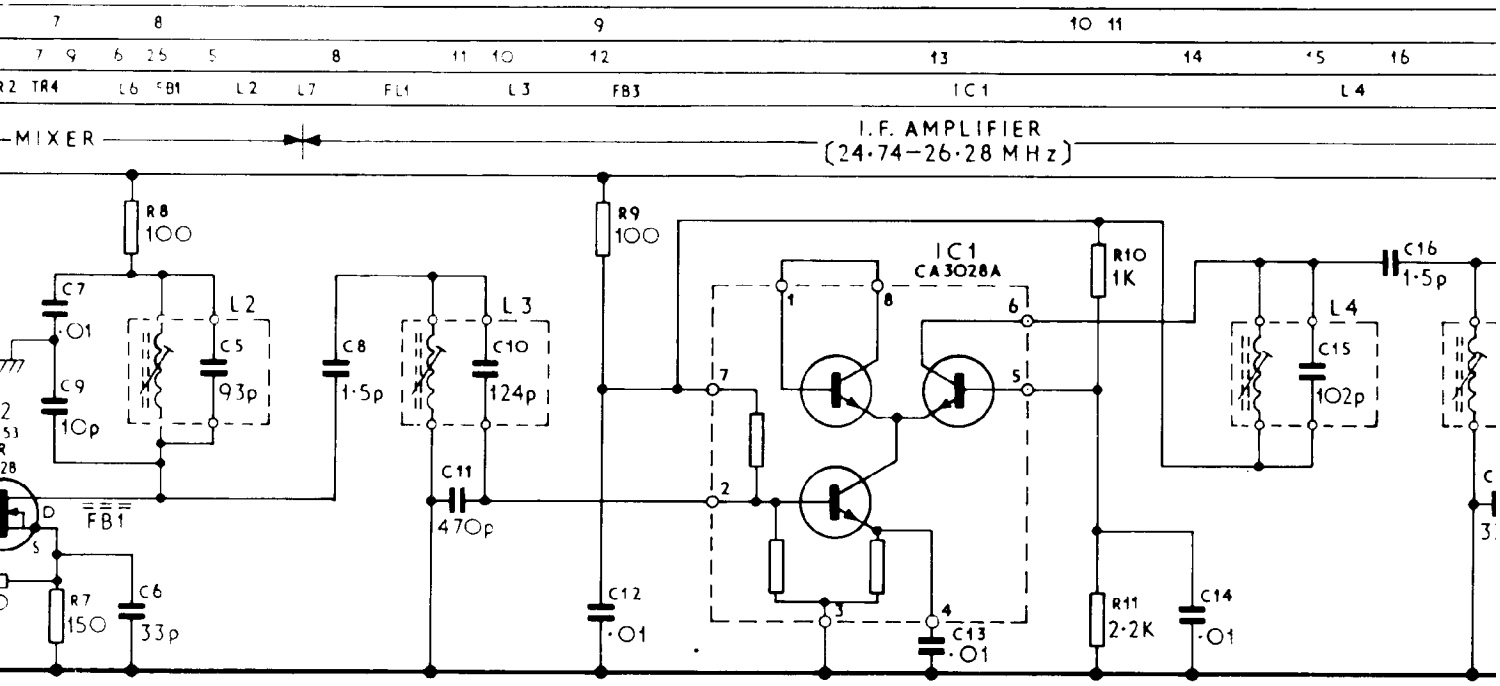


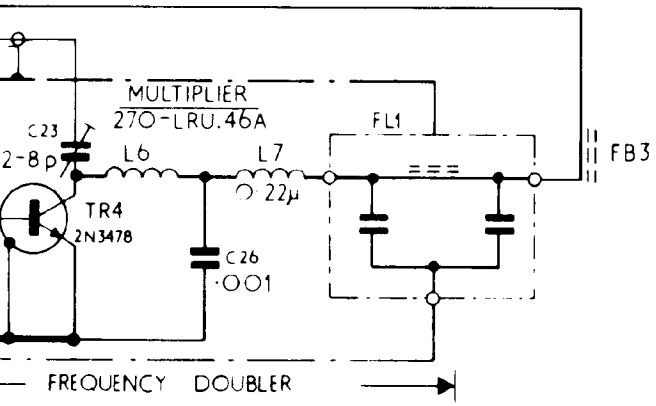
CA3028A
IC1



IN4148
D1



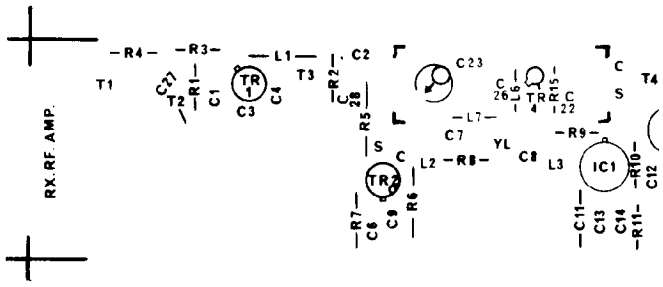


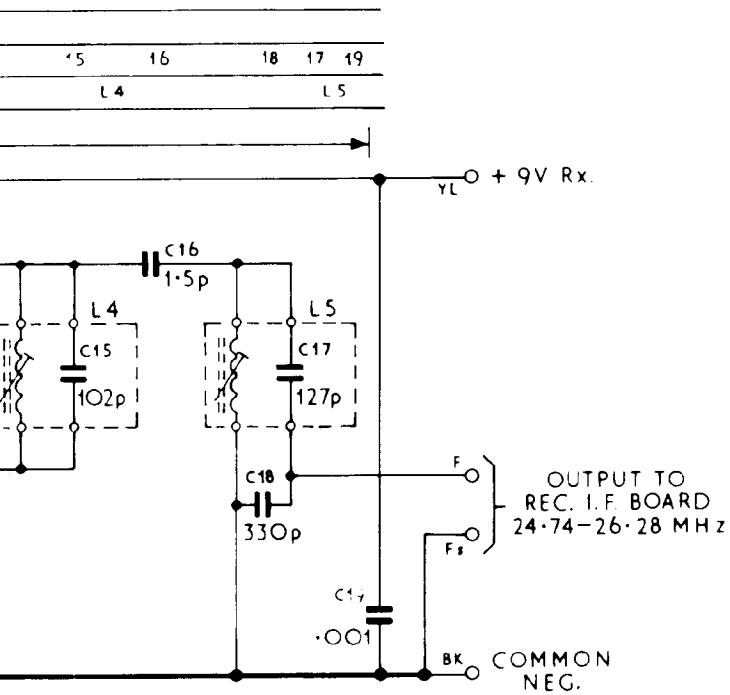


NOTES:

1. LOC. OSC. ACTUAL FREQ. = $\frac{12}{13}$ (CHANNEL FREQ. + 1
2. I.F. OUTPUT. ACTUAL FREQ. = (CHANNEL FREQ. −LOC

p.c.b. Component Code actual size.





$\frac{2}{3}$ (CHANNEL FREQ. + 10·7) MHz.

(CHANNEL FREQ. –LOC. OSC.) MHz.

tual size.

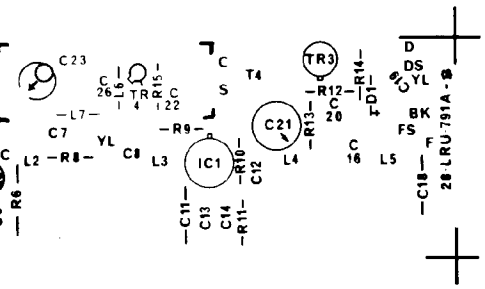


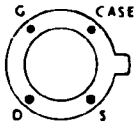
FIG. 17

342058

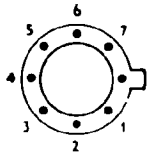
RECEIVER R.F. BOARD

28-LRU-791A

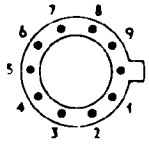
FIG. 17



TR1 2N3823



IC1 **CA3053**



IC2 CA3014

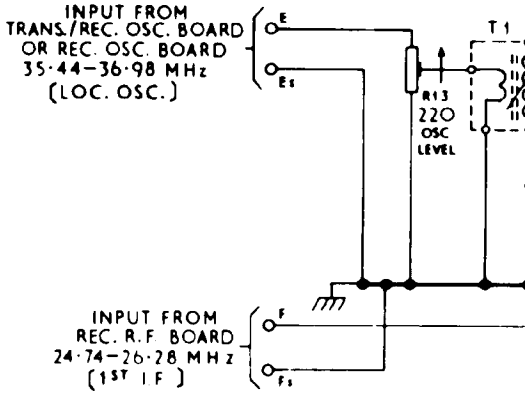
RESISTORS	13
CAPACITORS	
MISCELLANEOUS	T1

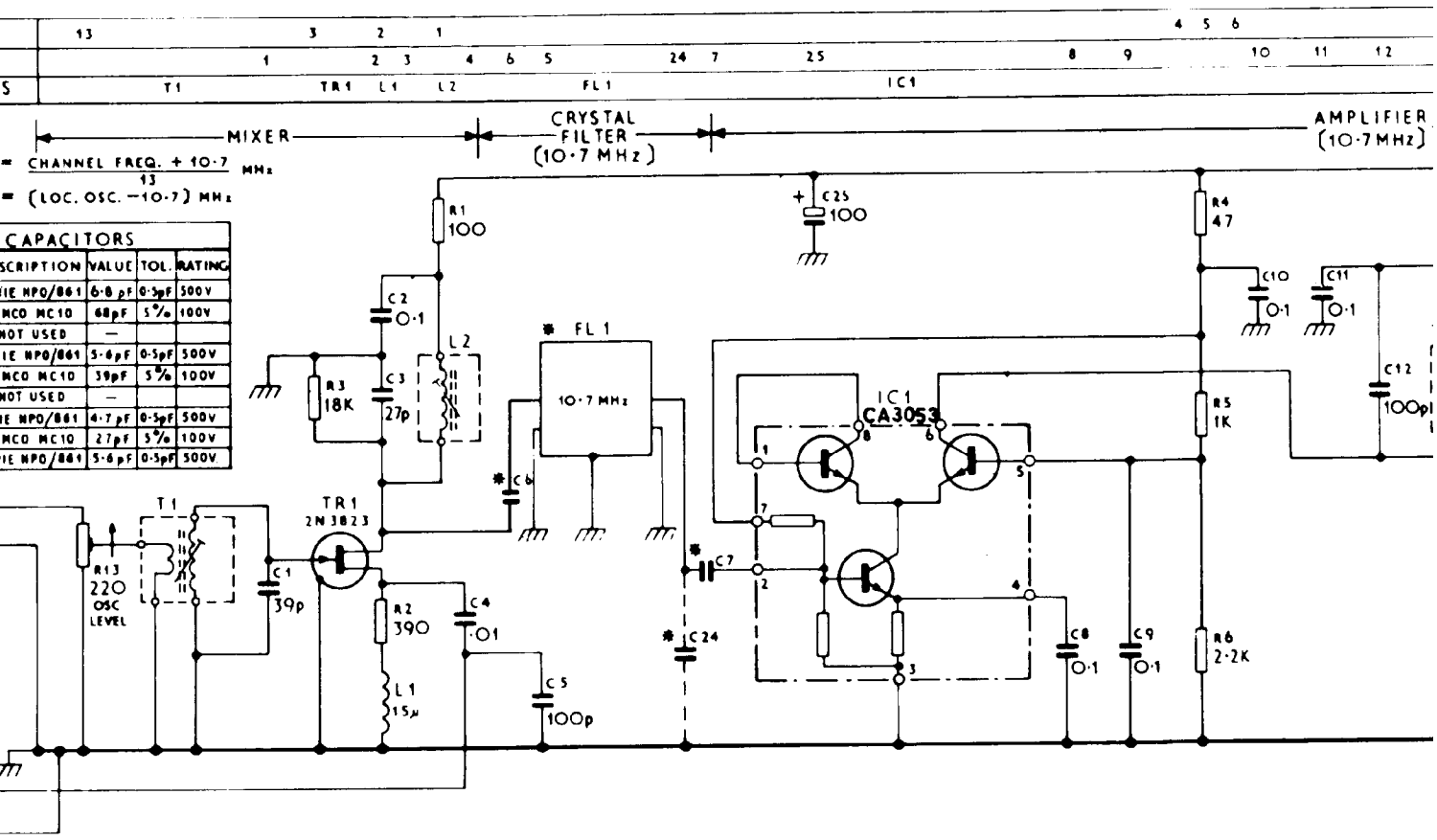
NOTES:

1. LOC. OSC. ACTUAL FREQ. = CHANNEL FREQ. + $\frac{\text{IF}}{13}$
2. 1ST I.F. ACTUAL FREQ. = (LOC. OSC. −10·7)

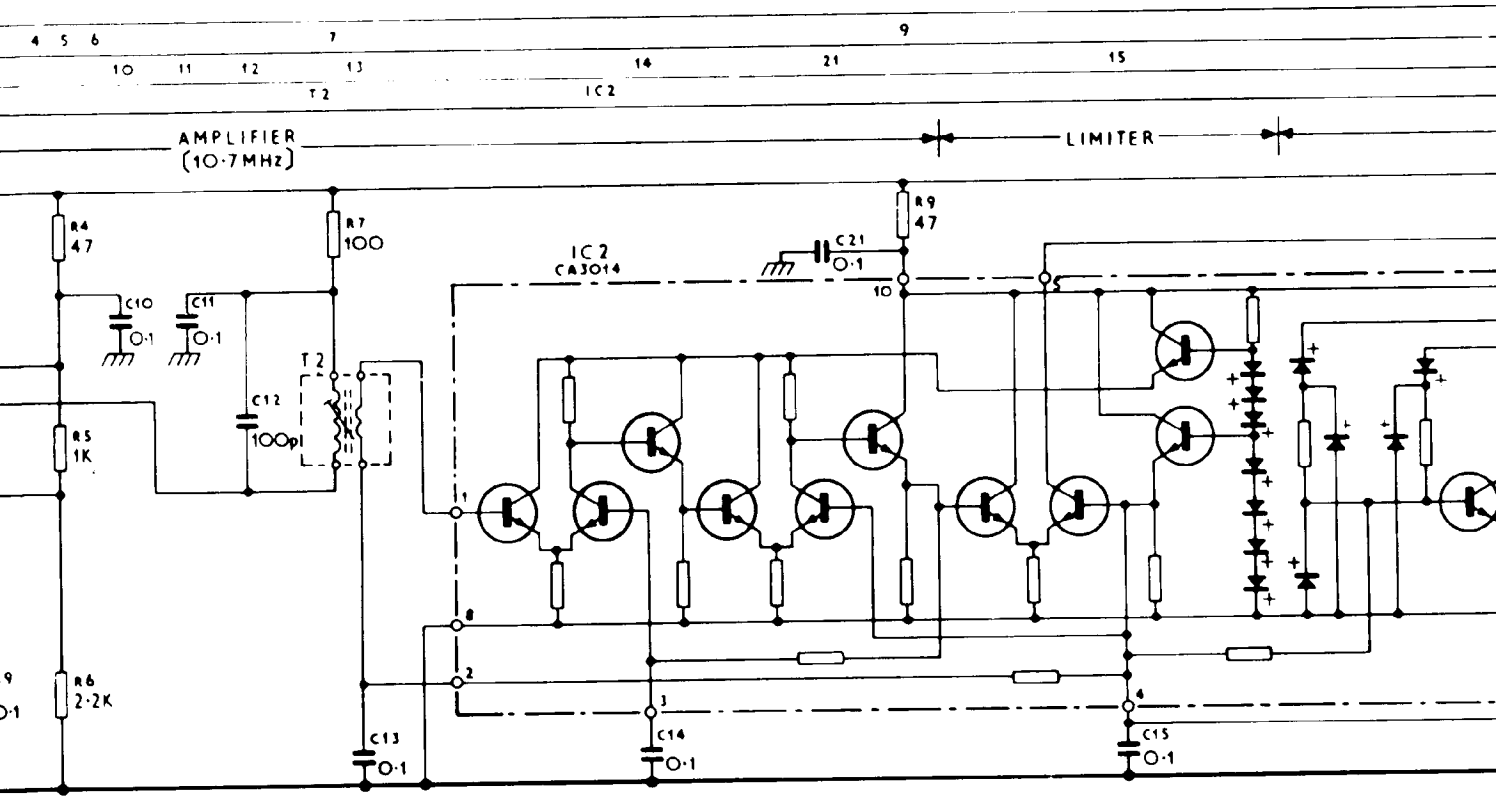
*

CRYSTAL FILTER			CAPACITORS				
CHAN. SEP.	CCT No	DESCRIPTION	CCT No	DESCRIPTION	VALUE	TOL.	W
25KHz	FL 1	S.T.C. 445-LQ4923J	C 6	ERIE NPO/861	6·8 pF	0·5pF	5
" "	"	ORHY Q	C 7	LEMCO MC10	68pF	5%	1
" "	"	QMF 10 P7	C 24	NOT USED	—		
25KHz	"	S.E.I. QC1121C	C 6	ERIE NPO/861	5·6pF	0·5pF	5
" "	"	" "	C 7	LEMCO MC10	39pF	5%	1
" "	"	" "	C 24	NOT USED	—		
50KHz	"	S.T.C. 445-LQJ923A	C 6	ERIE NPO/861	4·7pF	0·5pF	5
" "	"	" "	C 7	LEMCO MC10	27pF	5%	1
" "	"	" "	C 24	ERIE NPO/861	5·6pF	0·5pF	5

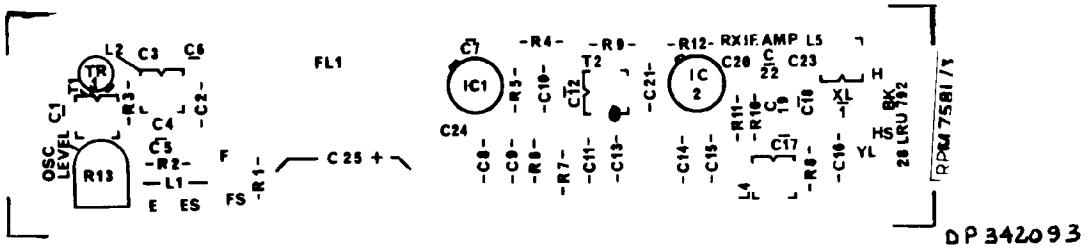


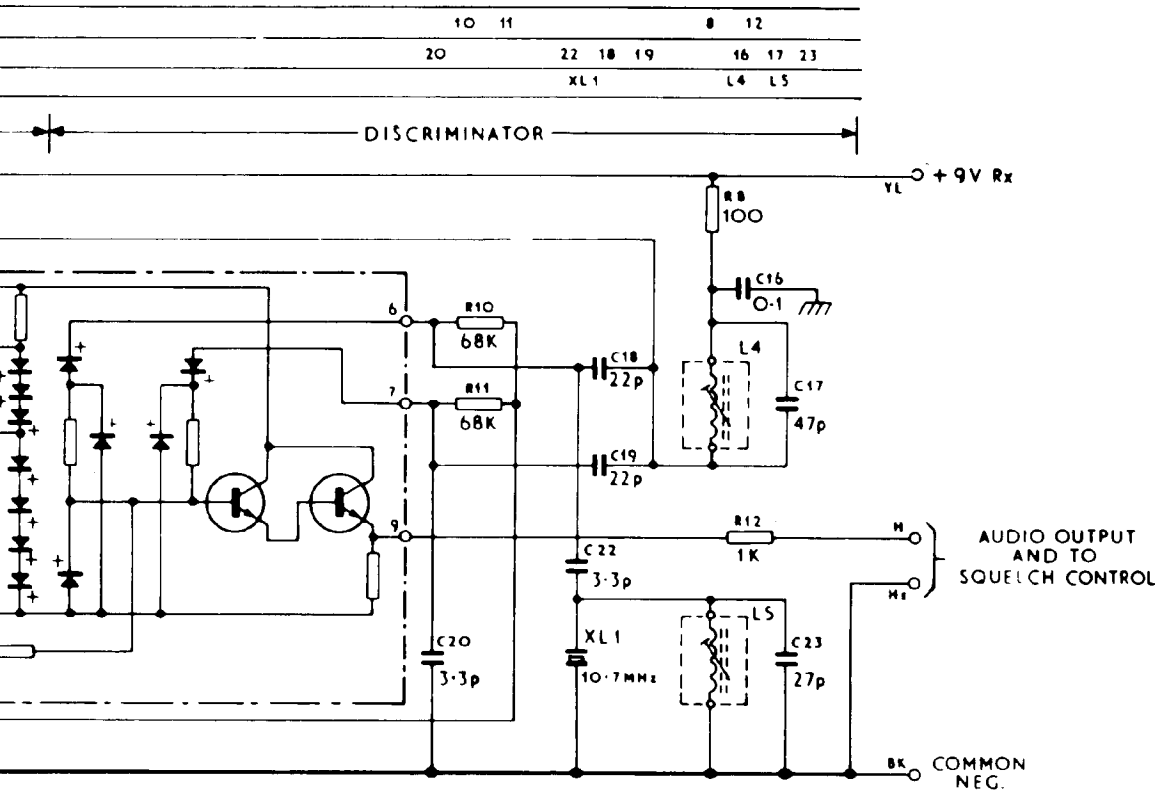


CAPACITORS			
SCRIPTION	VALUE	TOL.	RATING
IE NPO/861	6·8 pF	0·5pF	500V
NCO MC10	68pF	5%	100V
NOT USED	—		
IE NPO/861	5·6pF	0·5pF	500V
NCO MC10	39pF	5%	100V
NOT USED	—		
IE NPO/861	4·7 pF	0·5pF	500V
NCO MC10	27pF	5%	100V
IE NPO/861	5·6 pF	0·5pF	500V



p.c.b. Component Code actual size.





342093

FIG. 18

342436

RECEIVER I.F. BOARD 400 420MHz

28-LRU-792D

FIG. 18

RESISTORS	13
CAPACITORS	
MISCELLANEOUS	T1

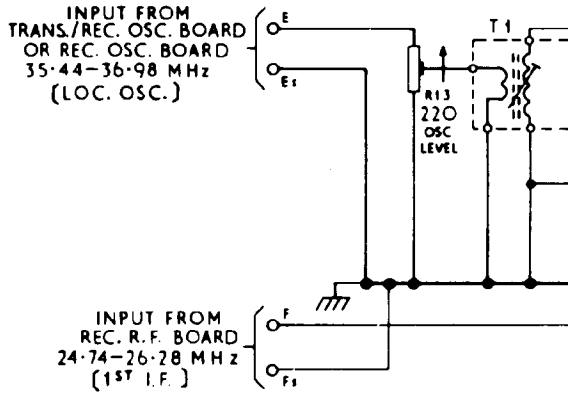
NOTES:

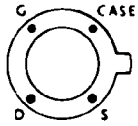
1. LOC. OSC. ACTUAL FREQ. = $\frac{\text{CHANNEL FREQ.} + 10{\cdot}7}{13}$

2. 1ST I.F. ACTUAL FREQ. = (LOC. OSC. −10·7) MHz

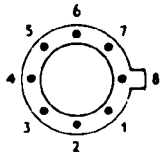
*

CRYSTAL FILTER			CAPACITORS				
CHAN. SEP.	CCT No	DESCRIPTION	CCT No	DESCRIPTION	VALUE	TOL.	RATING
25KHz	FL1	S.T.C. 445-LQU923J	C6	ERIE NPO/861	6·8pF	0·5pF	500V
" "	"	ORHY Q	C7	LEMCO MC10	68pF	5%	100V
" "	"	QMF 10 P7	C24	NOT USED	—		
25KHz	"	S.E.I. QC1121C	C6	ERIE NPO/861	5·6pF	0·5pF	500V
" "	"	" "	C7	LEMCO MC10	39pF	5%	100V
" "	"	" "	C24	NOT USED	—		
50KHz	"	S.T.C. 445-LQU923A	C6	ERIE NPO/861	4·7pF	0·5pF	500V
" "	"	" "	C7	LEMCO MC10	27pF	5%	100V
" "	"	" "	C24	ERIE NPO/861	5·6pF	0·5pF	500V

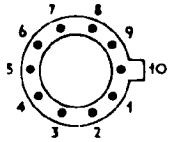




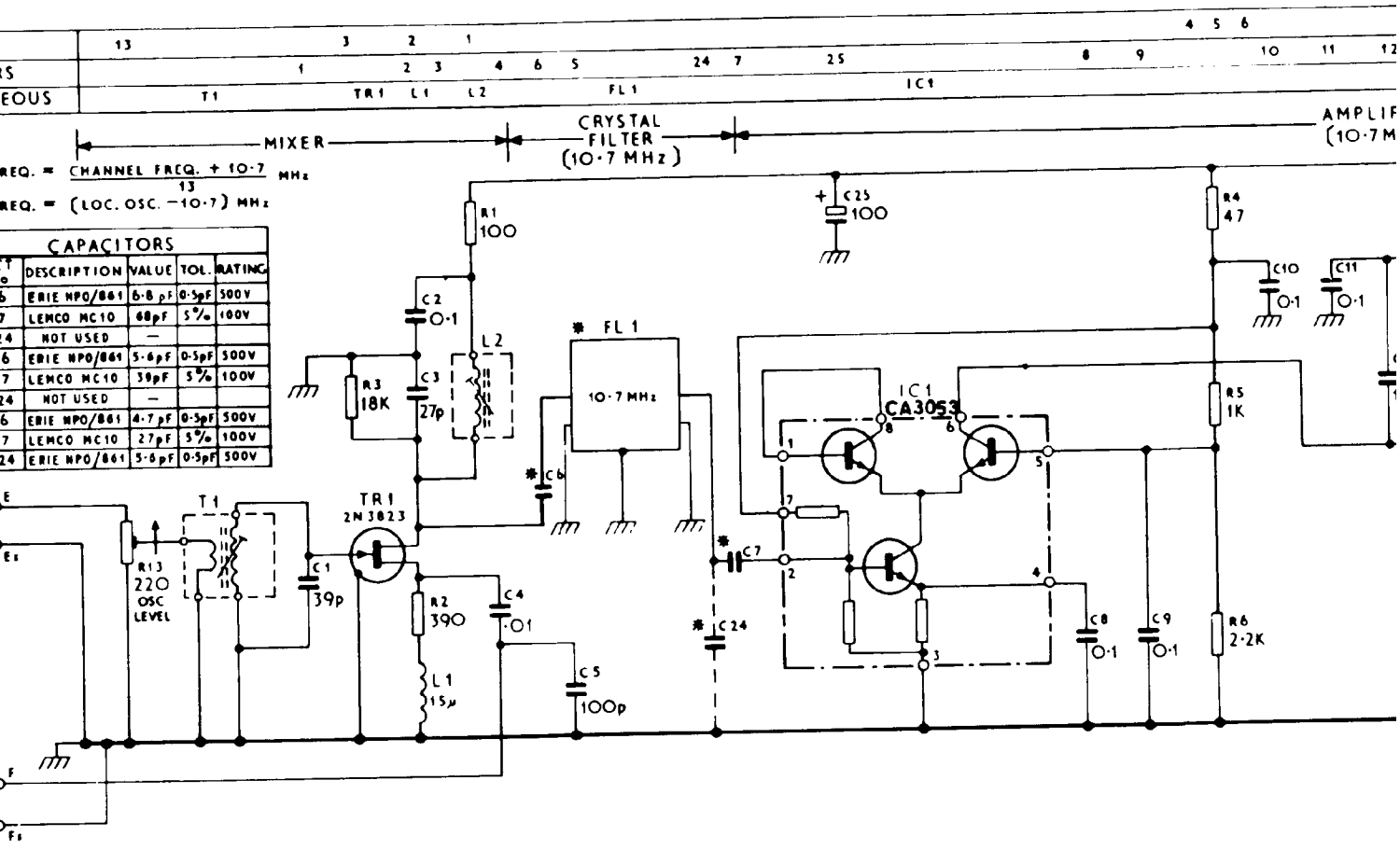
TR1 2N3823

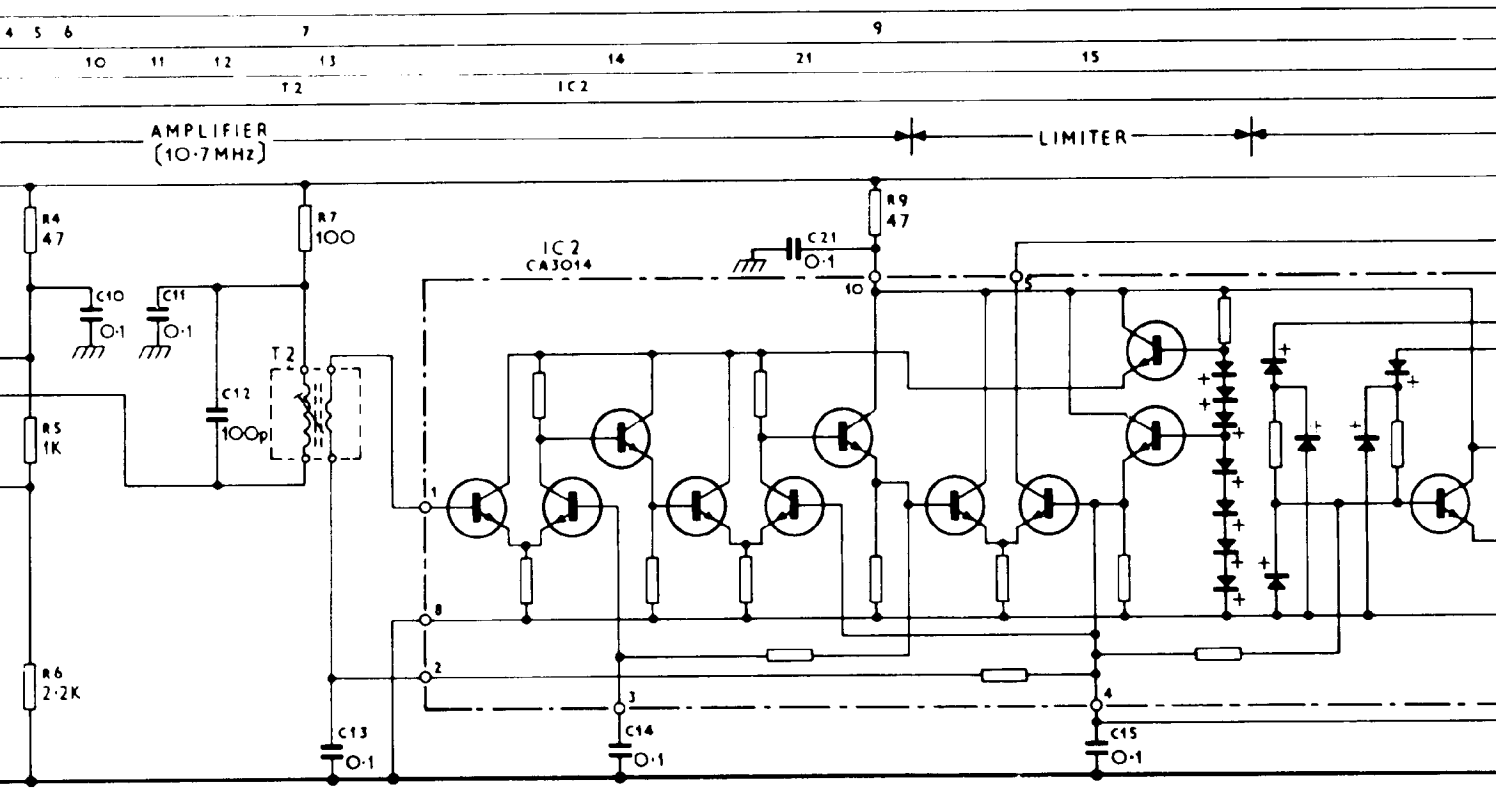


IC1 CA3053

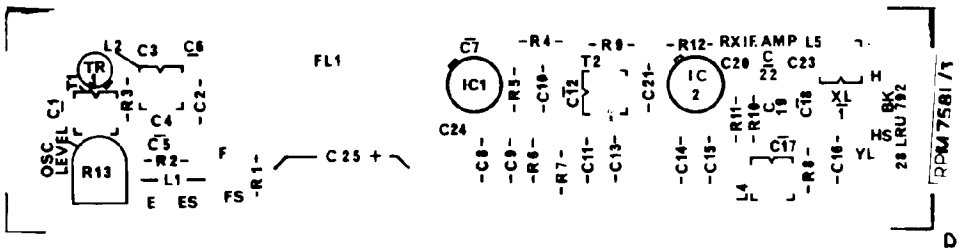


IC2 CA3014





p.c.b. Component Code actual size.



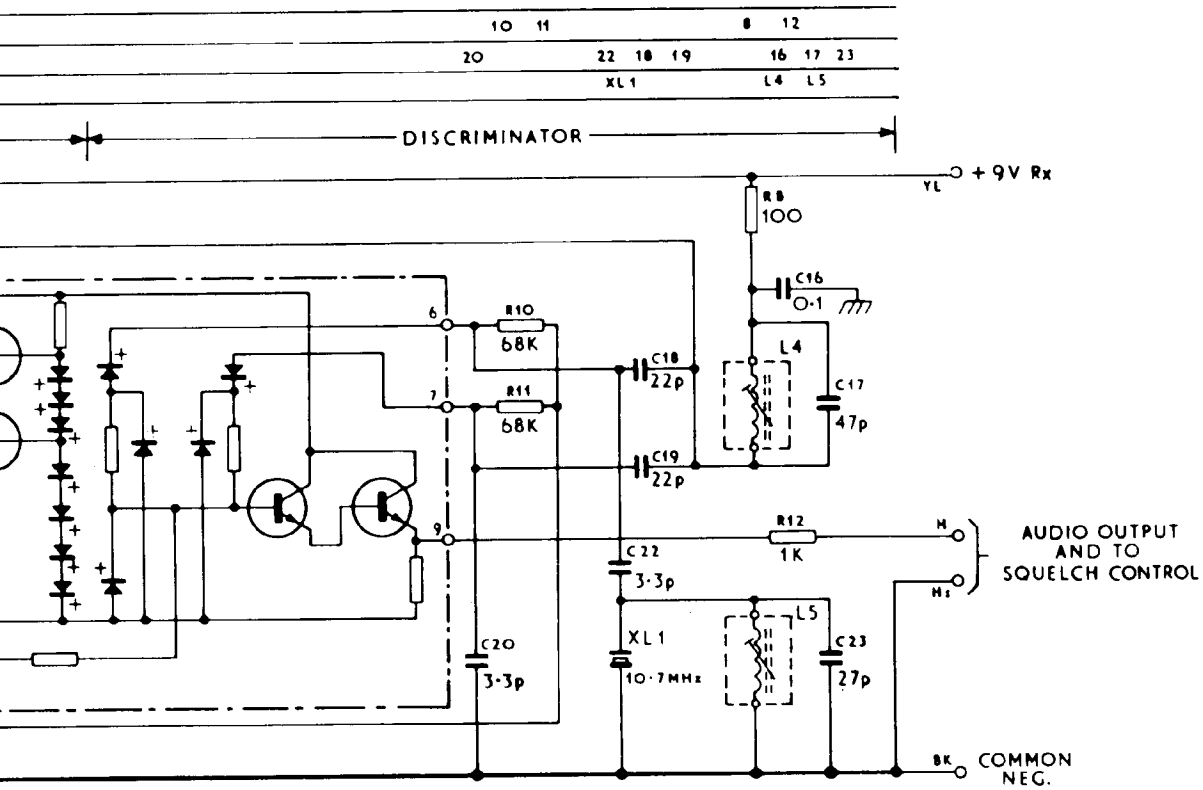
DP 342093

FIG. 19

342086

RECEIVER I.F. BOARD

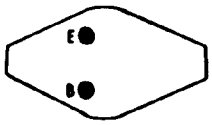
28-LRU-792A



DP 342093

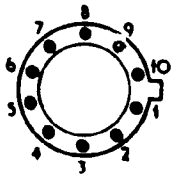
FIG. 19

BC171 AND BC212 TR1, TR2, TR3, TR4, TR5, TR8

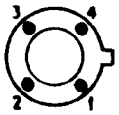


C-CASE

BD106A TR6, TR7

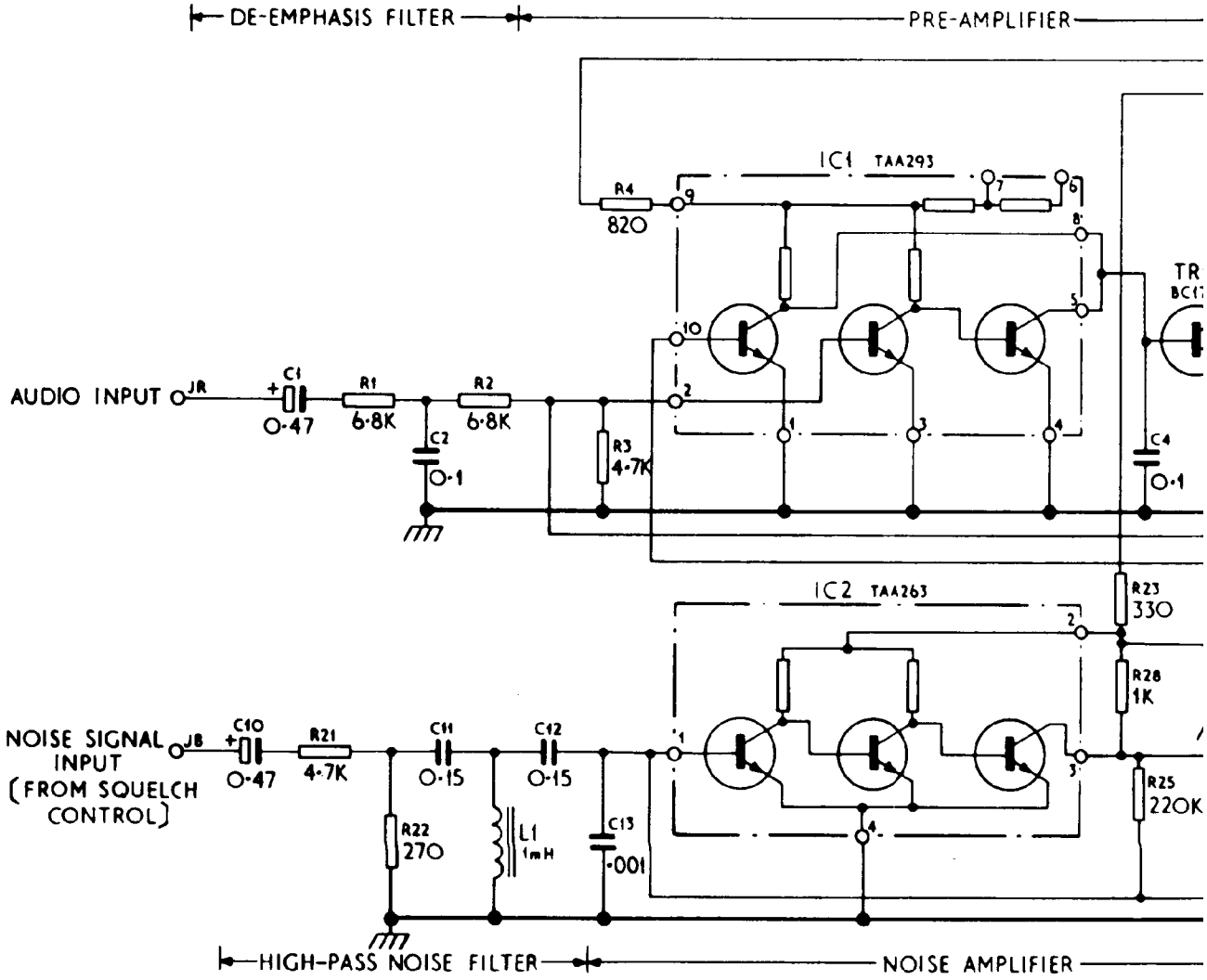


TAA293 IC1



TAA263 IC2

RESISTORS	21 1 22 2 3 4 23 28 25 27
CAPACITOR	10 1 2 11 12 13 4
MISCELLANEOUS	L1 IC1 IC2 TR



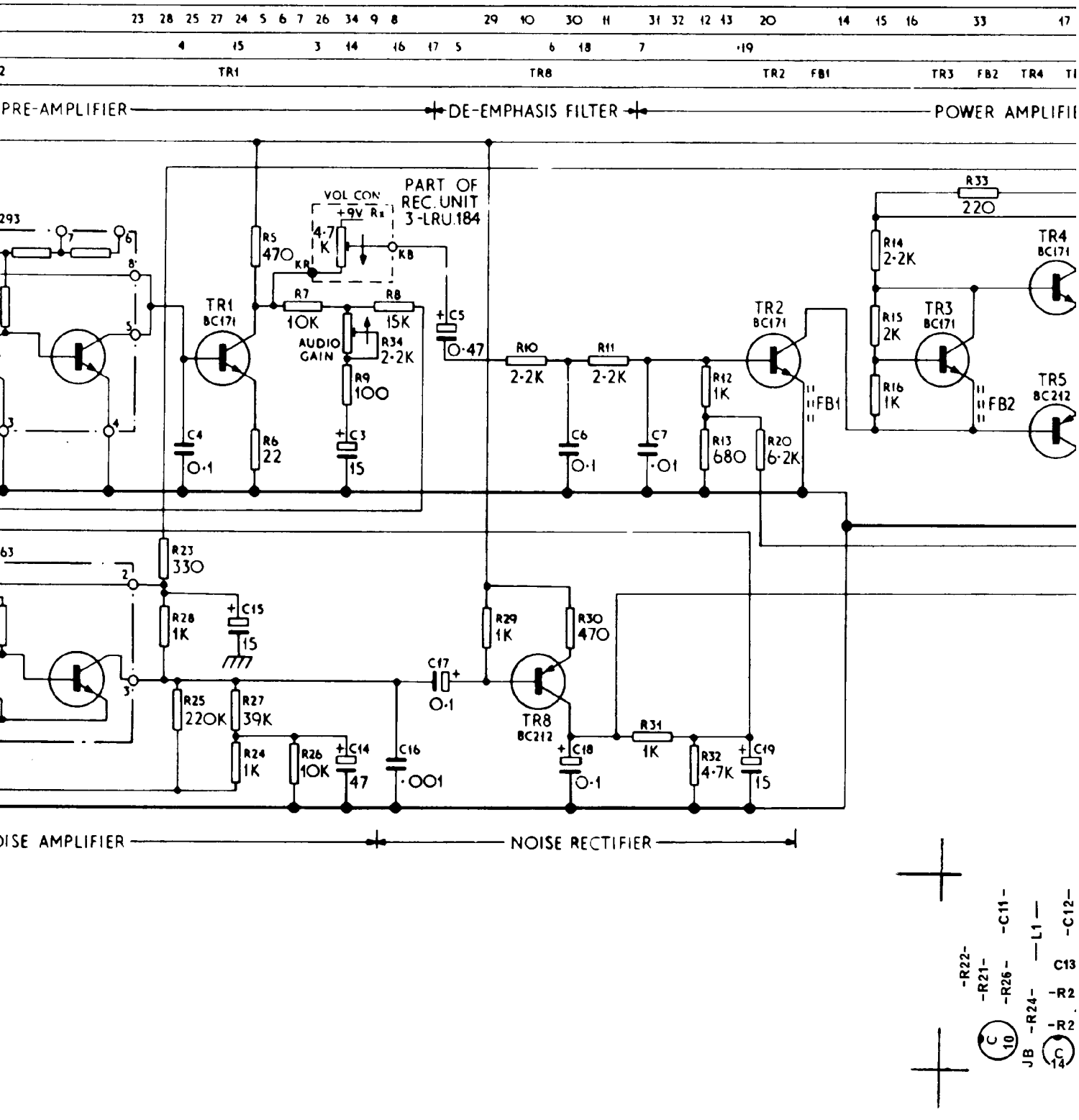
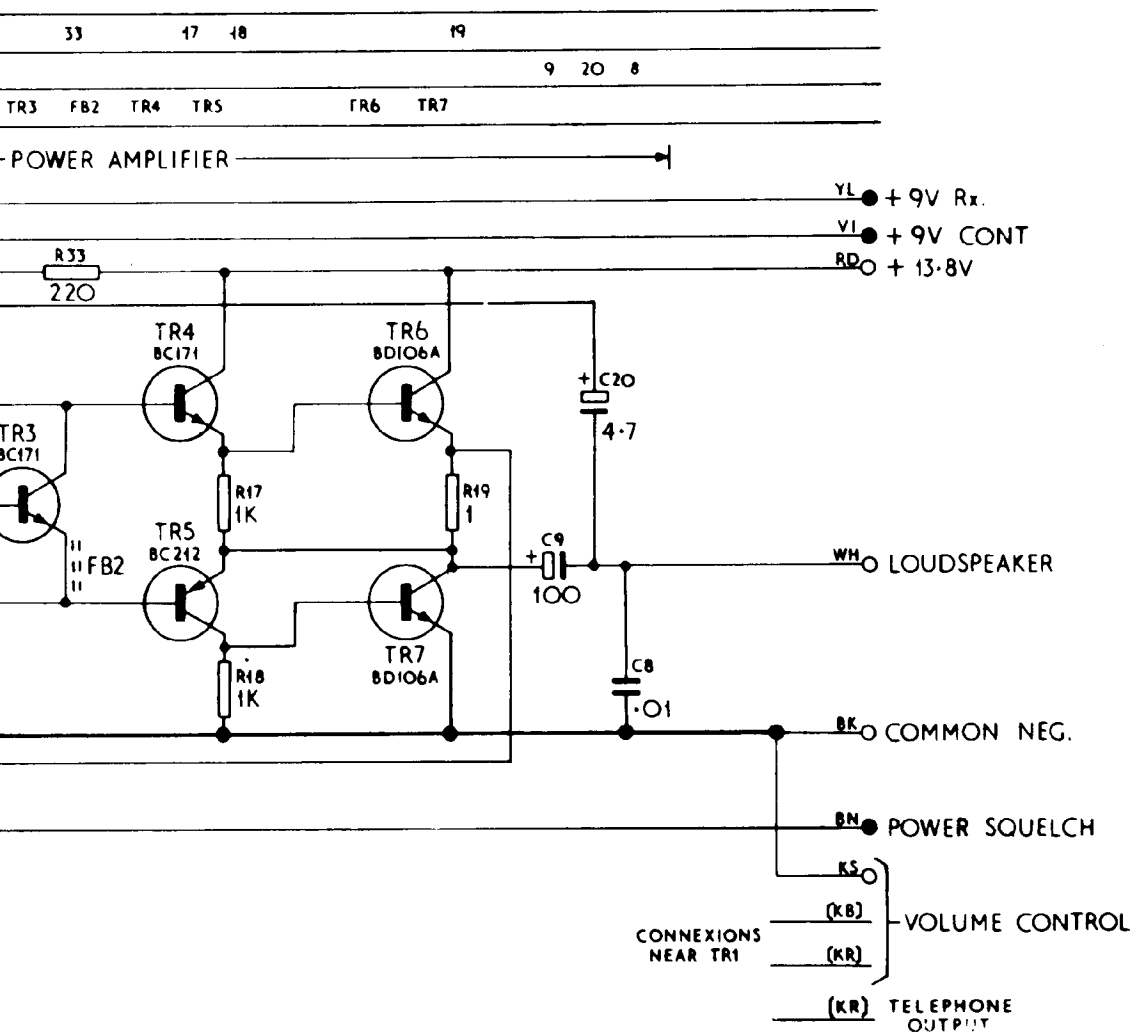


FIG. 20

342094

RECEIVER A.F. & SQUELCH BOARD

28-LRU-793A



p.c.b. Component Code actual size.

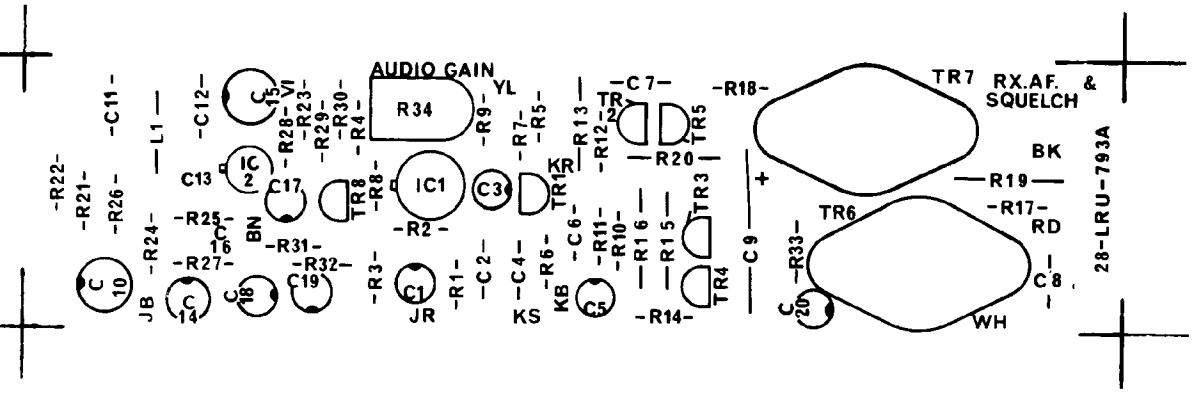
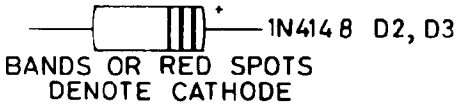
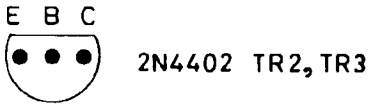
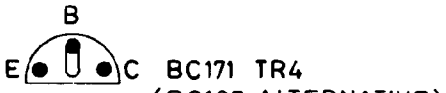


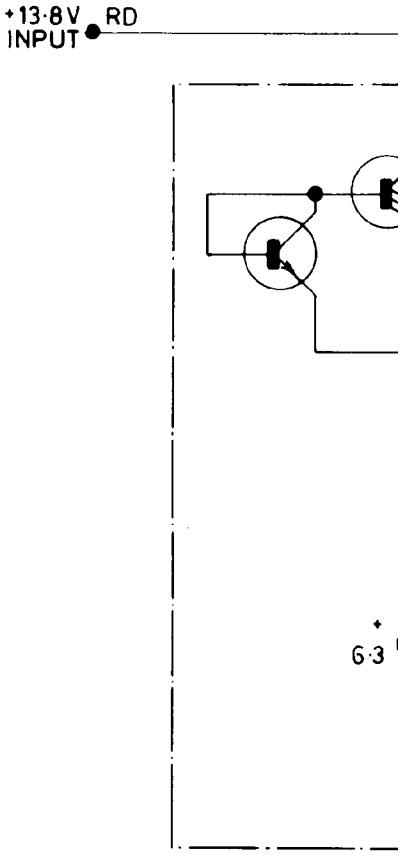
FIG. 20

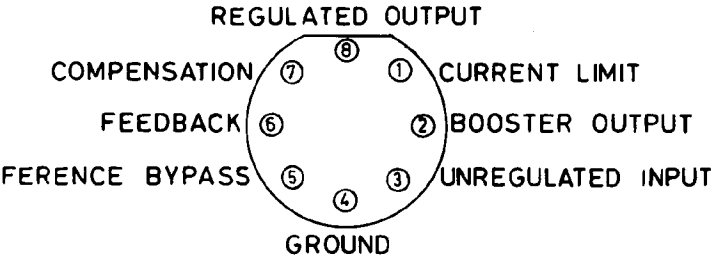


RESISTORS	
CAPACITORS	
MISCELLANEOUS	I

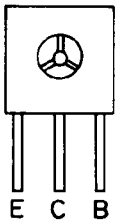








IC1
LA300
OR
LM300



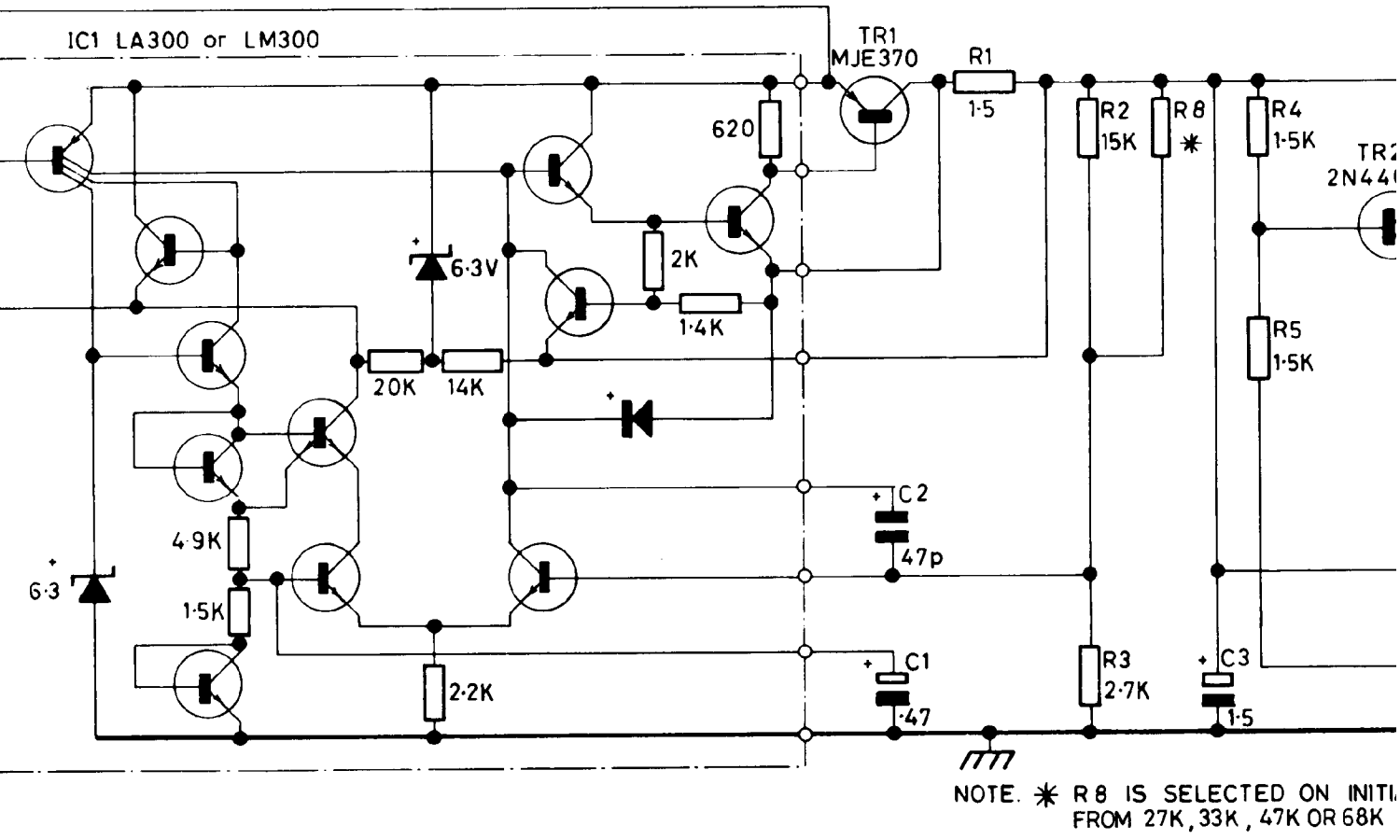


FIG. 21

342098

POWER SUPPLY BOARD (ALTERNATIVE)

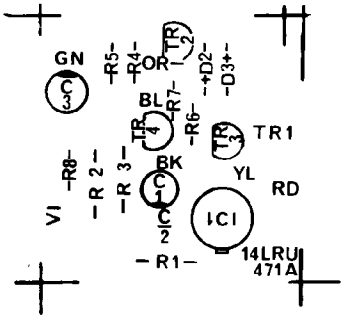
14-LRU-471

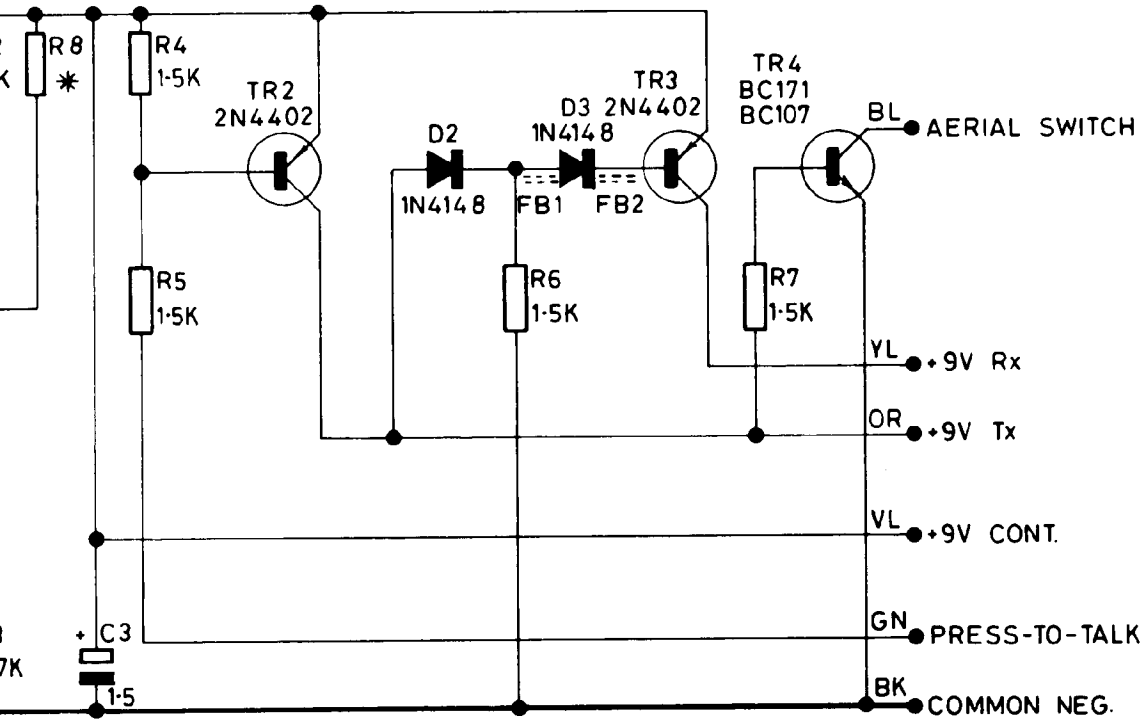
8 4 5 6 7

3

TR2 D2 FB1 D3 FB2 TR3 TR4

p.c.b. Component Code actual size.





IS SELECTED ON INITIAL TESTS
1 27K, 33K, 47K OR 68K

FIG. 21

RESISTORS	1 2 3 4 5 6 7 8 9 1
CAPACITORS	1 2
MISCELLANEOUS	D1 D2 D3 TR2 TR1 TR3 TR4 D4

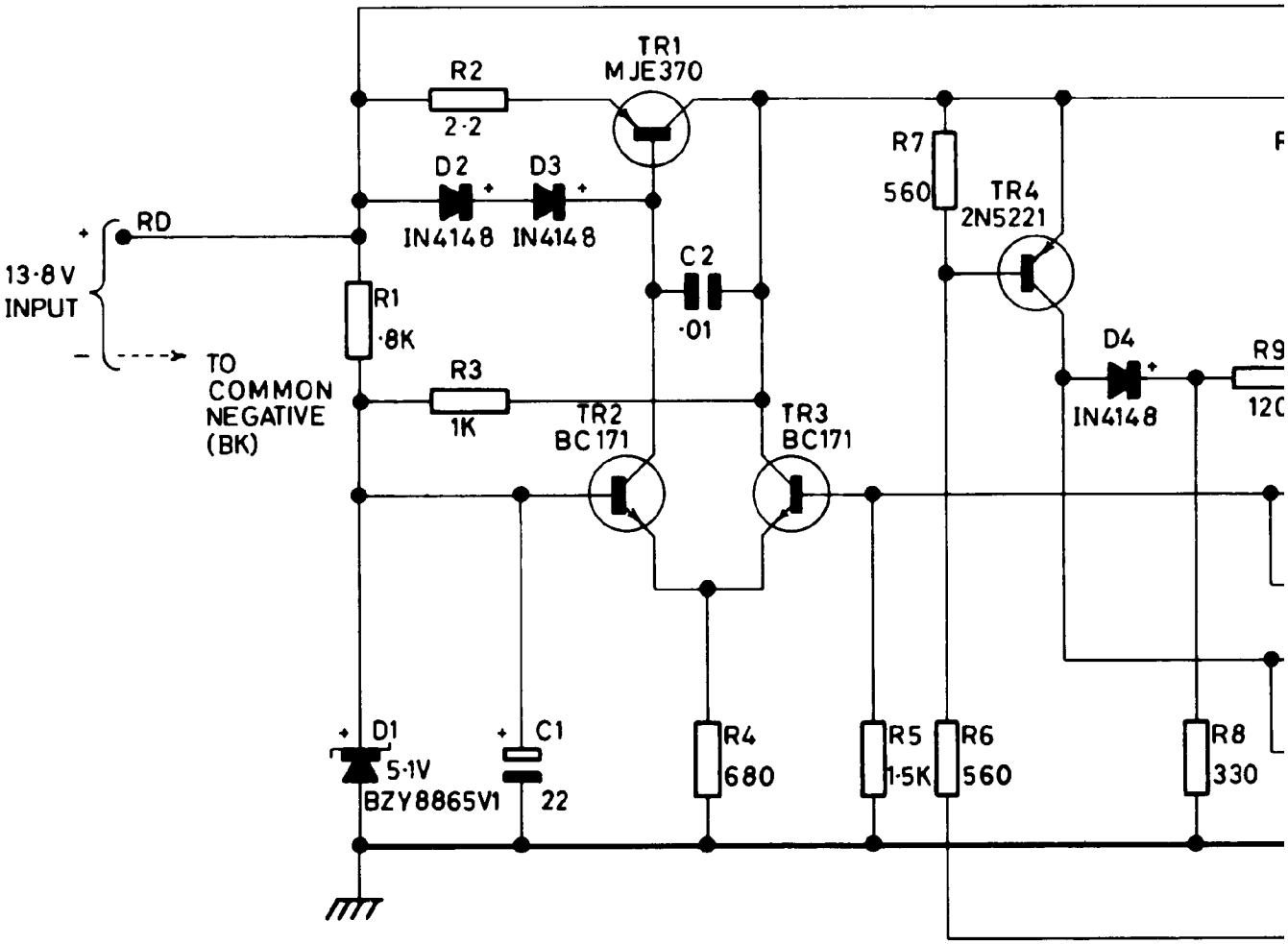


FIG. 22

351130

POWER SUPPLY BOARD (ALTERNATIVE)

14-LMU-3A

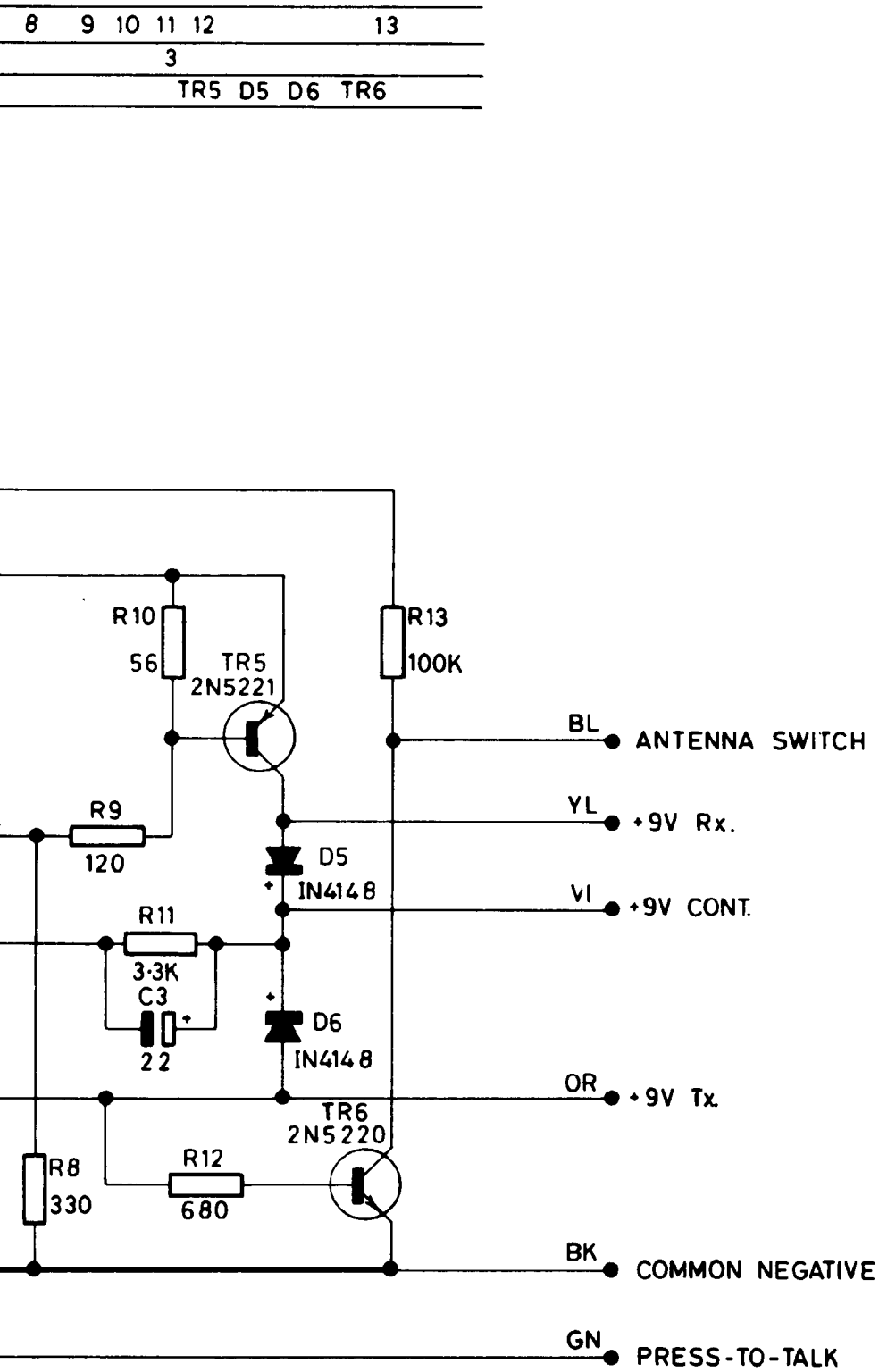
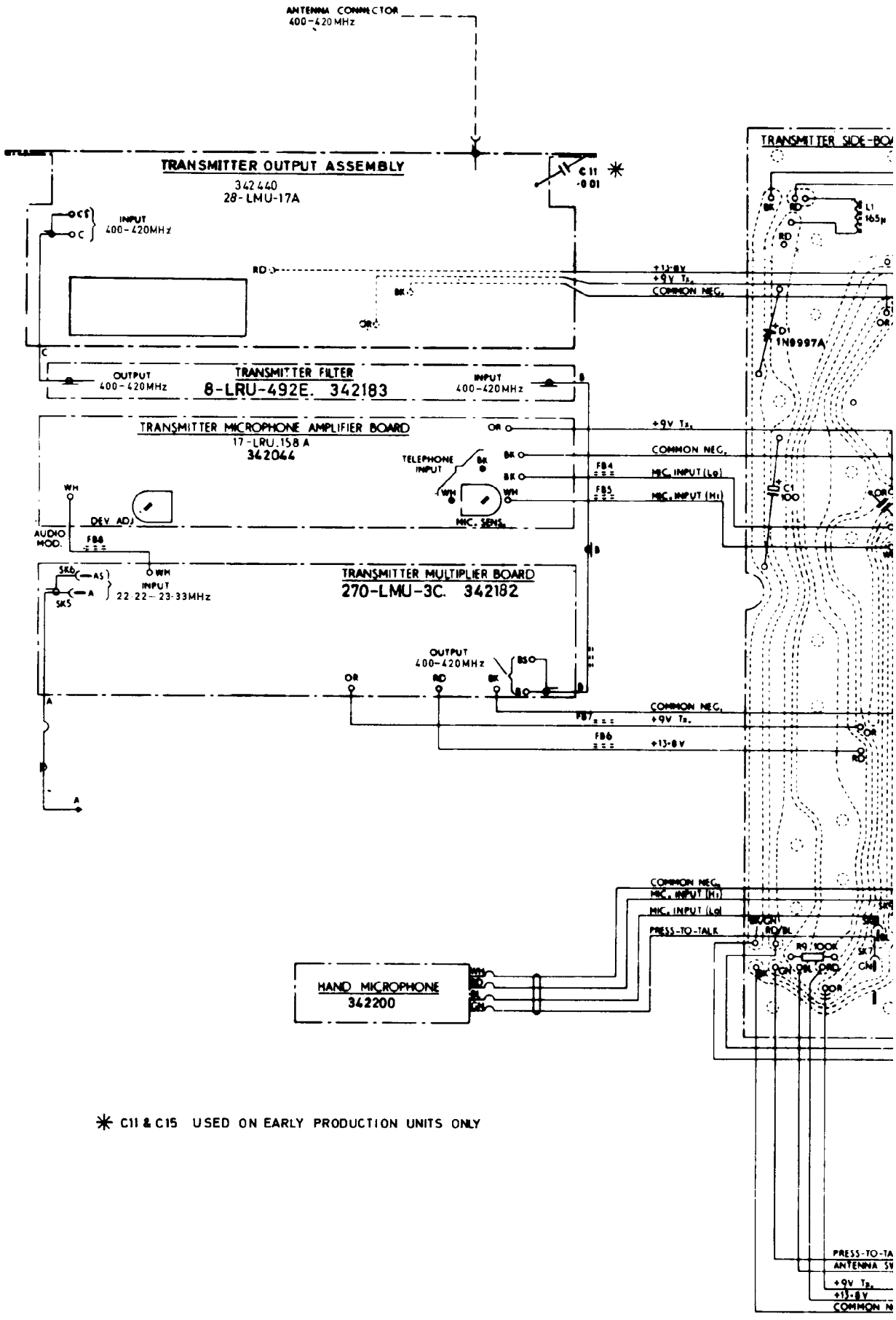


FIG. 22



✳ C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY

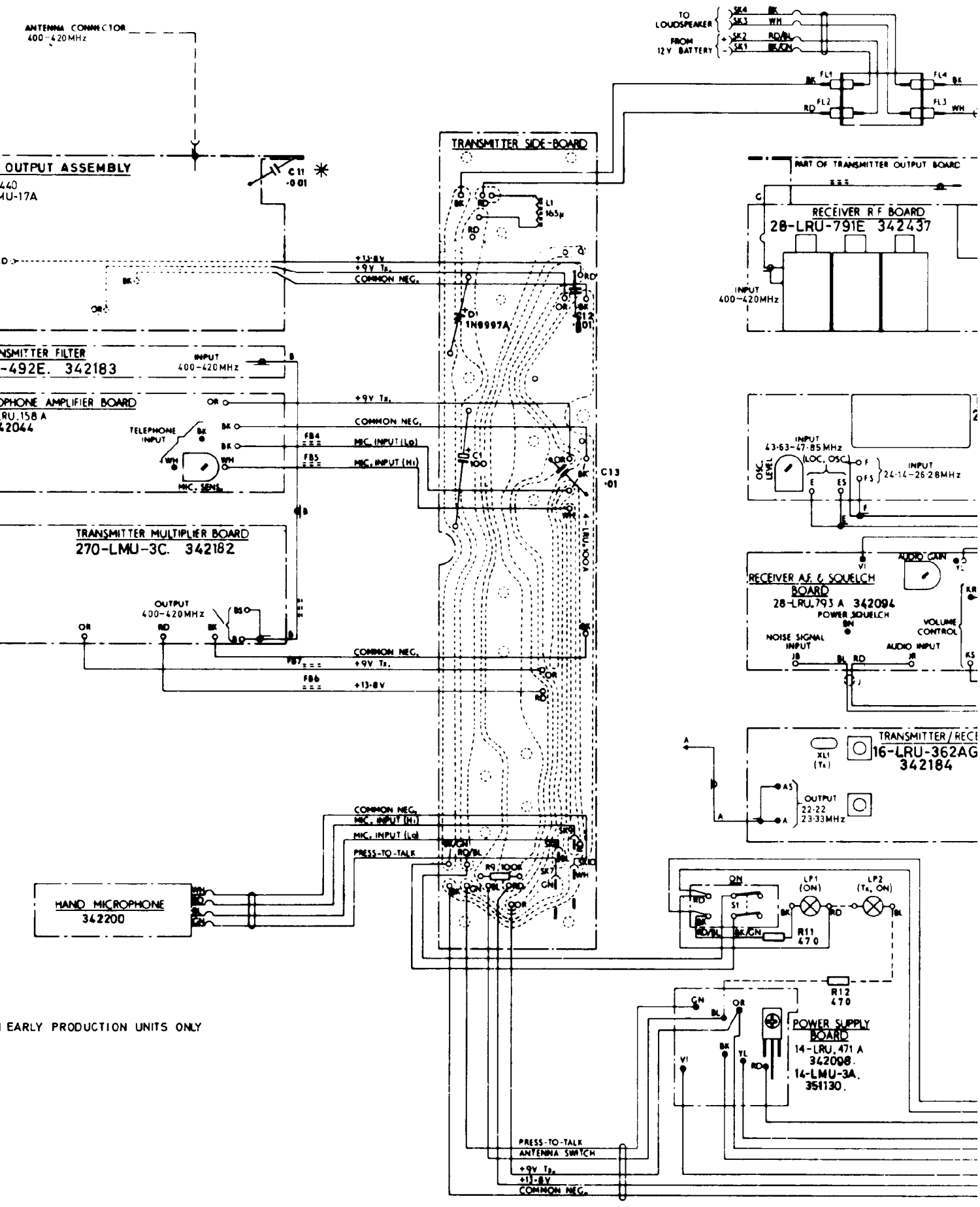
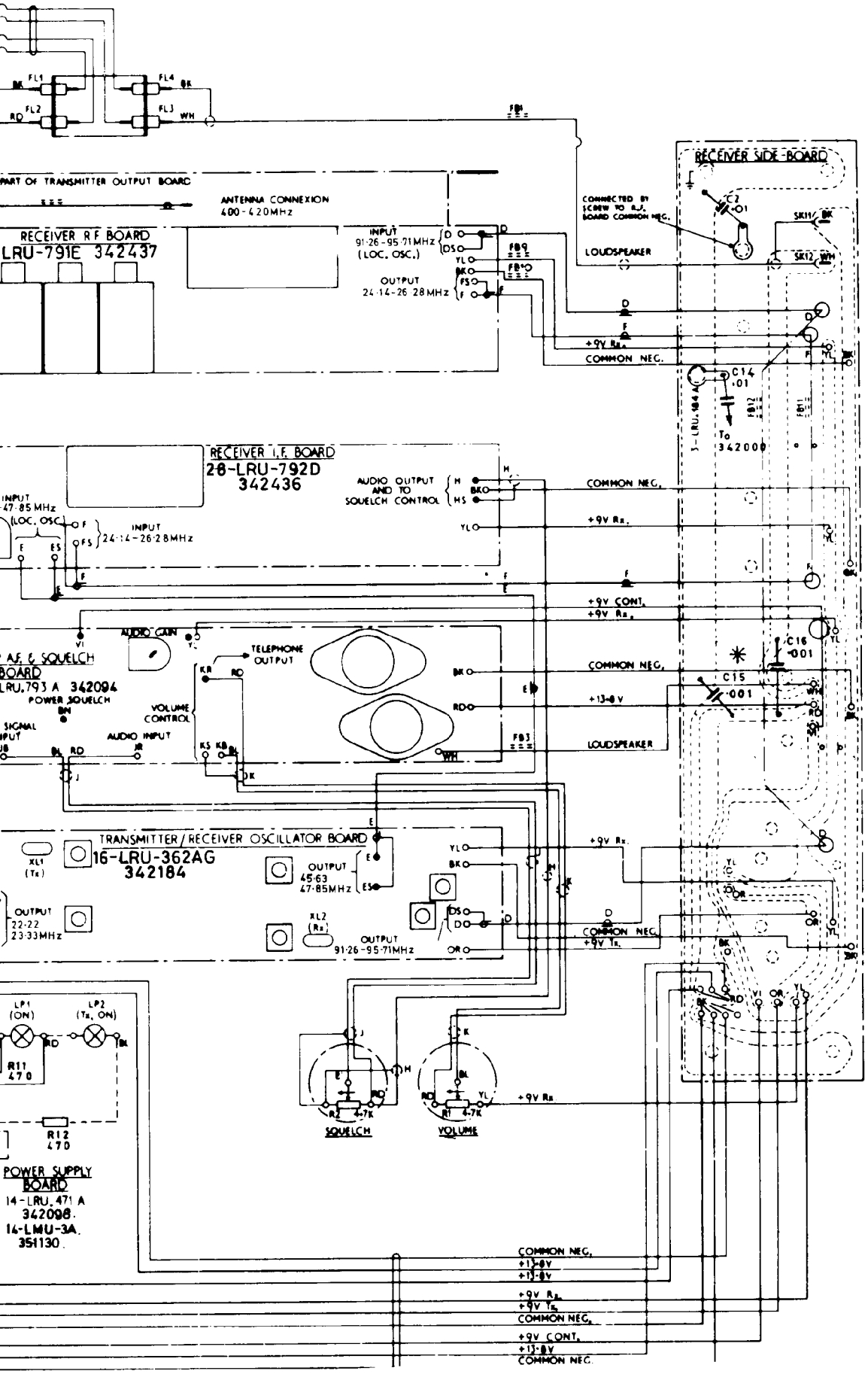
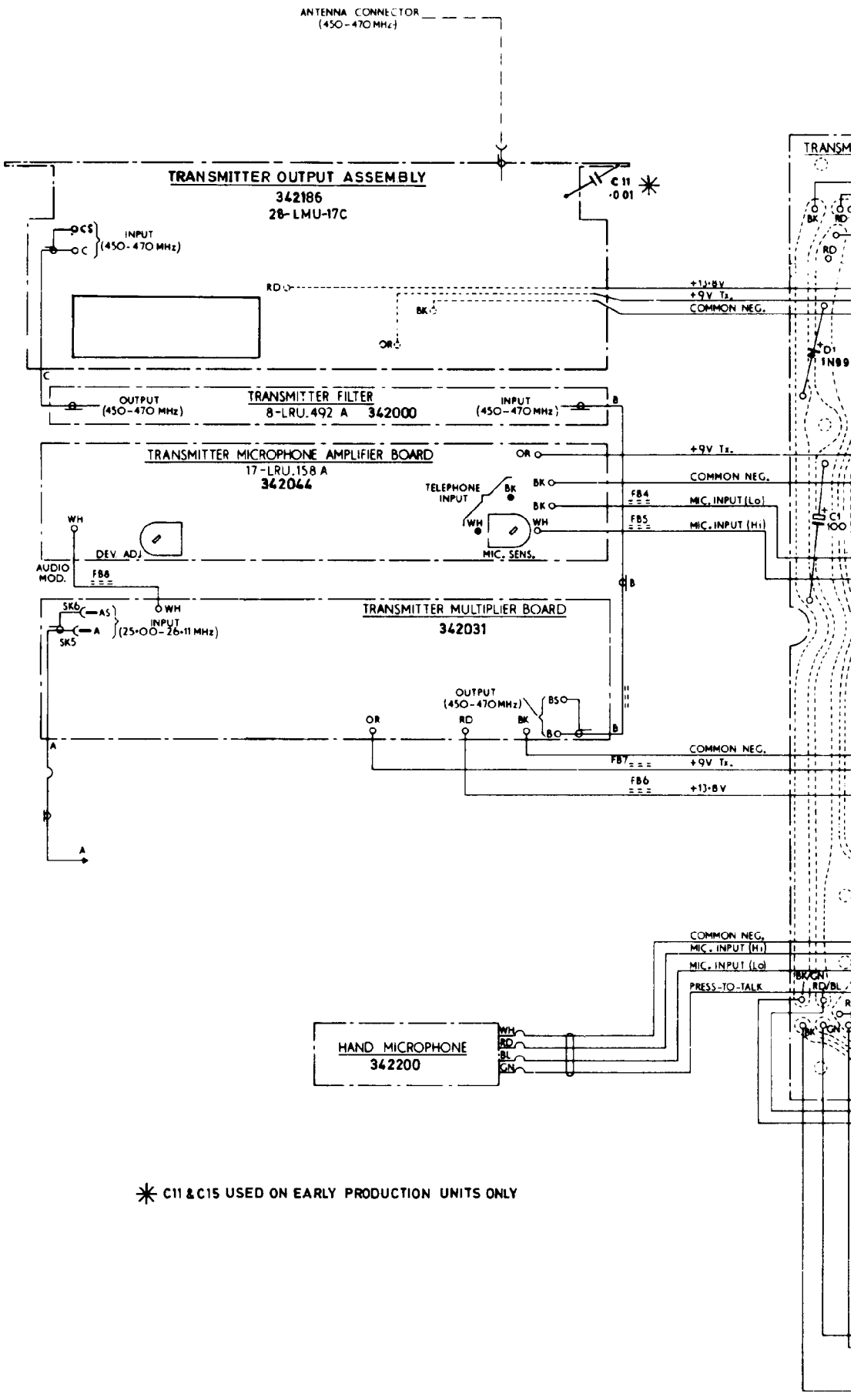


FIG. 23

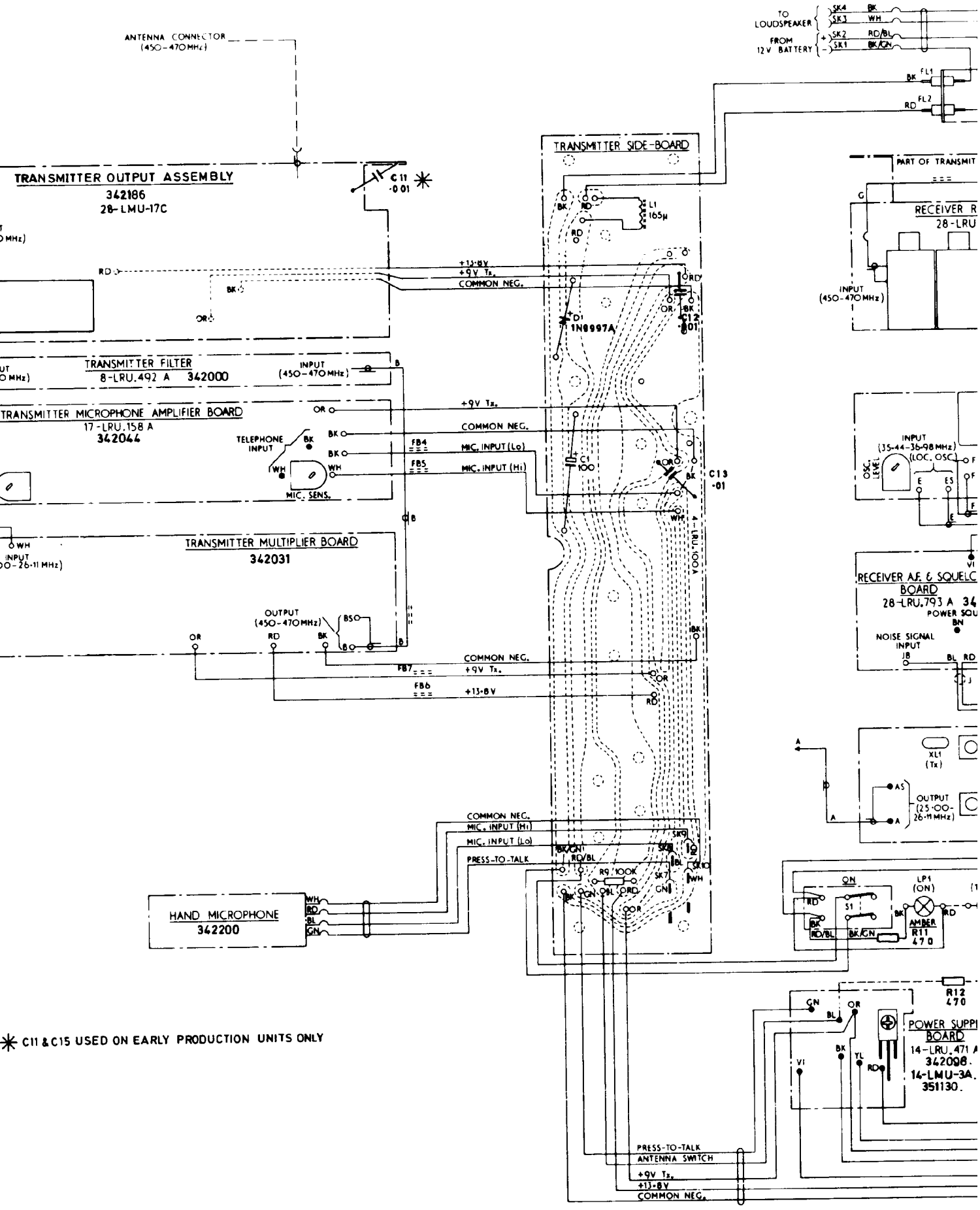


INTERCONNEXION DIAGRAM
SINGLE-CHANNEL
400-420 MHz

FIG. 23



✳ C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY



* C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY

FIG. 24

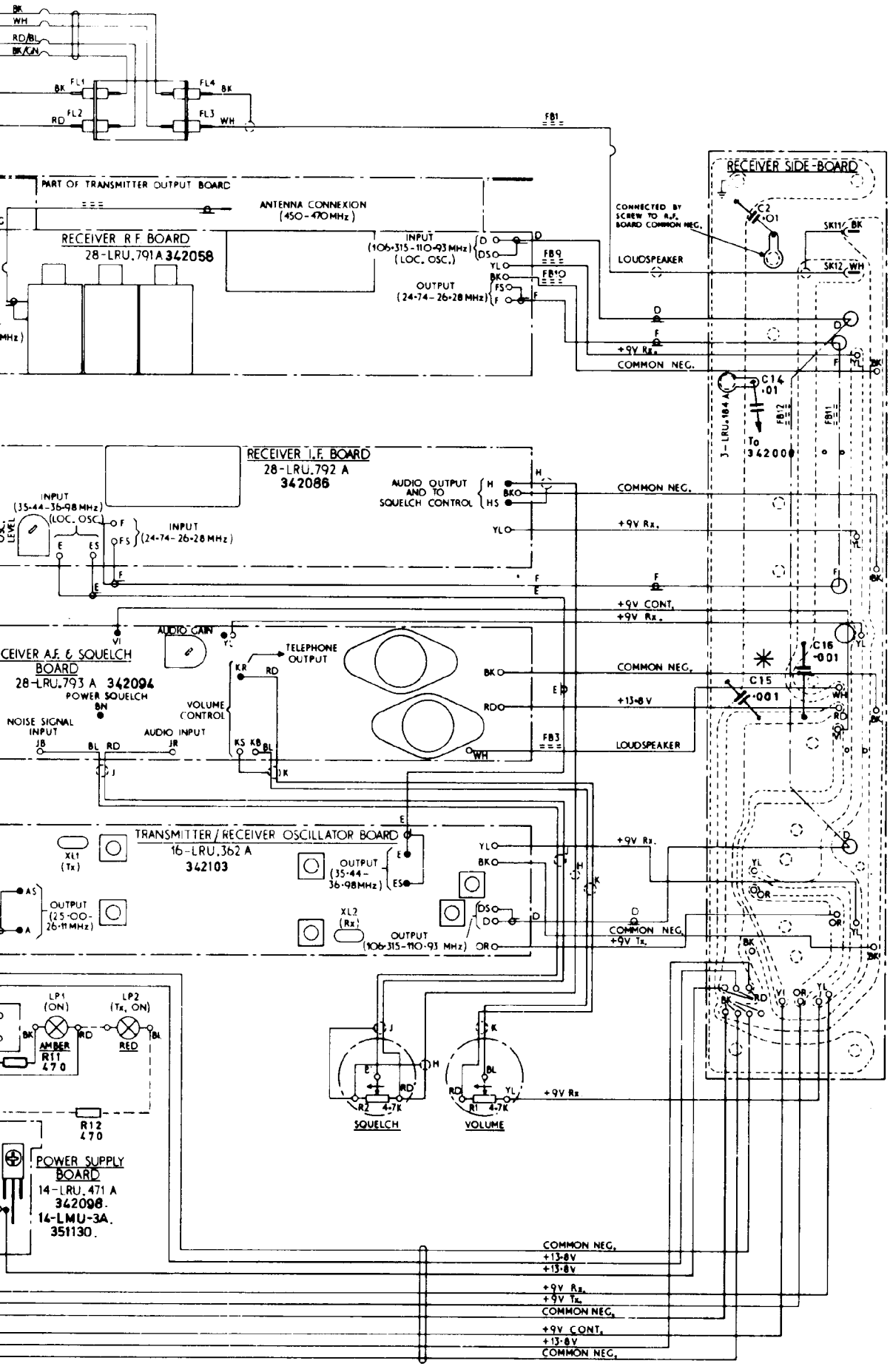
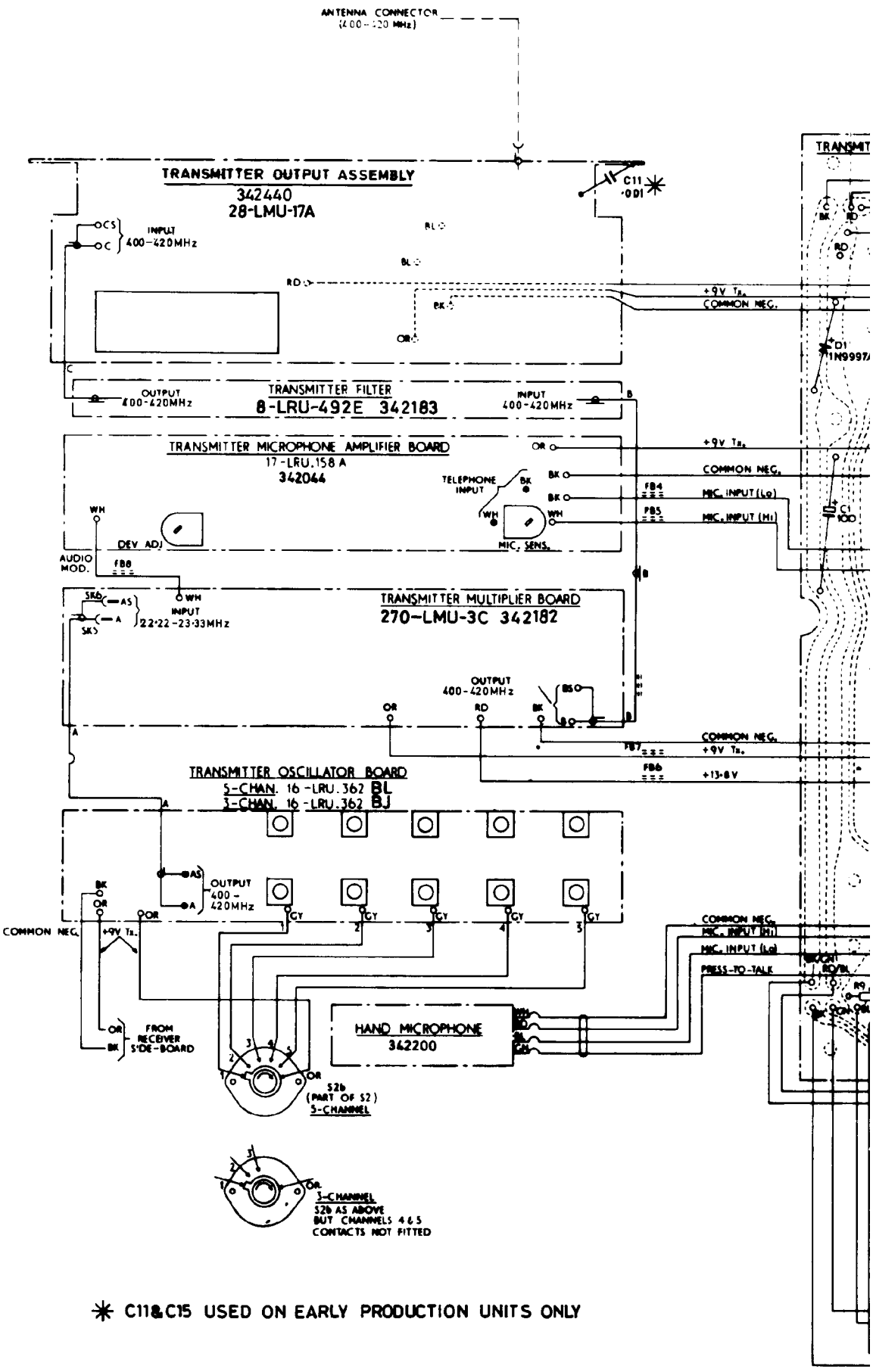


FIG. 24



✳ C11&C15 USED ON EARLY PRODUCTION UNITS ONLY

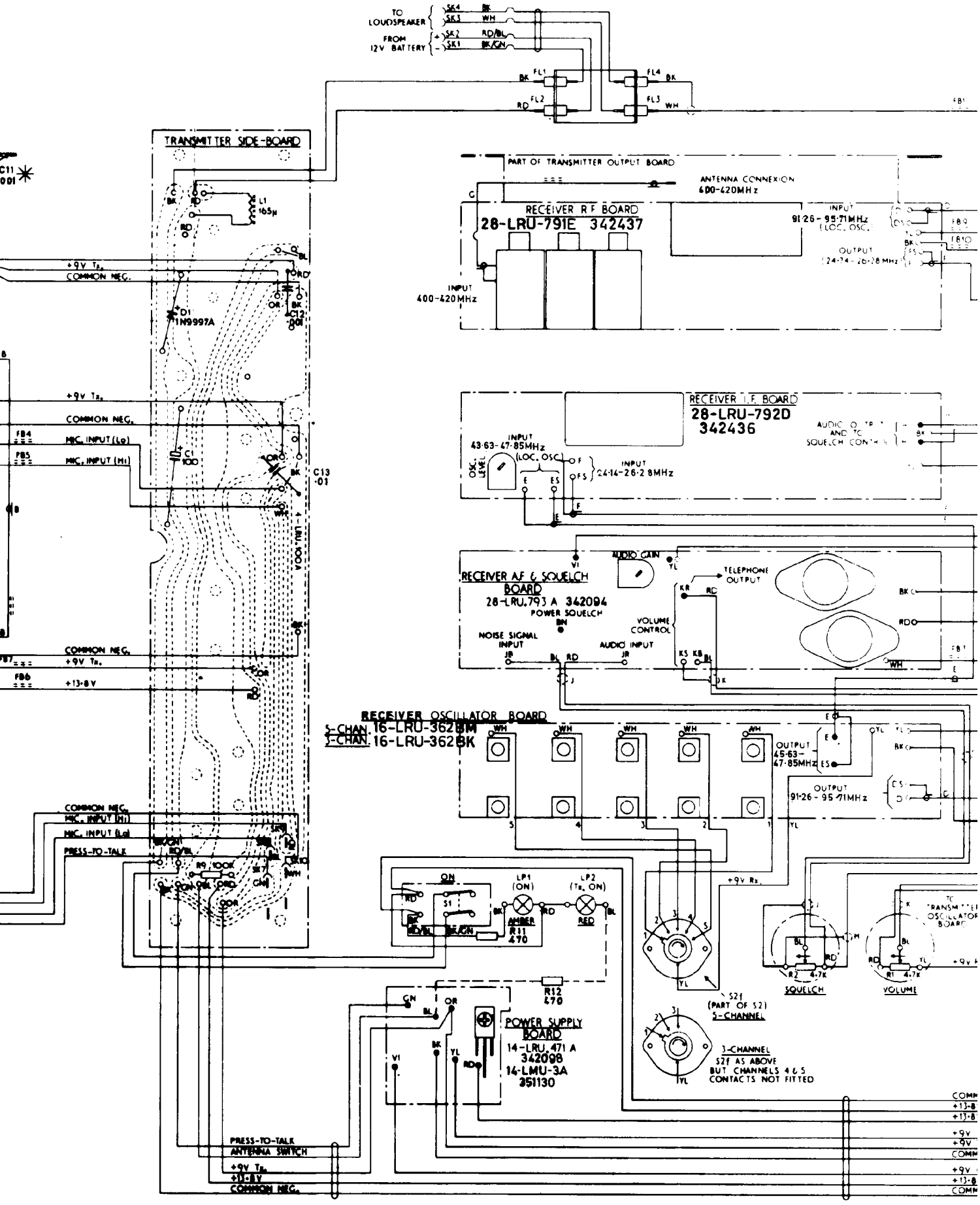
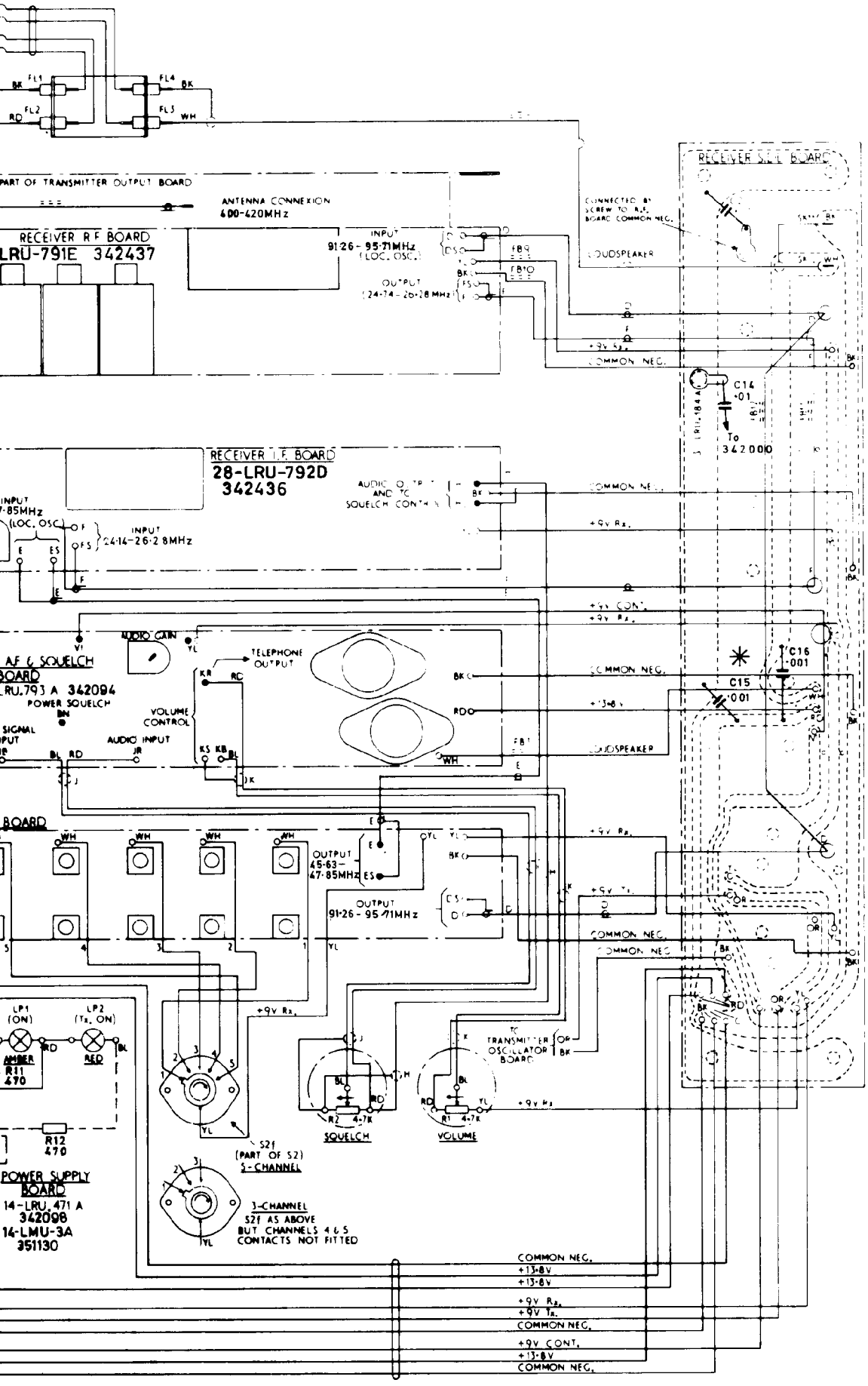


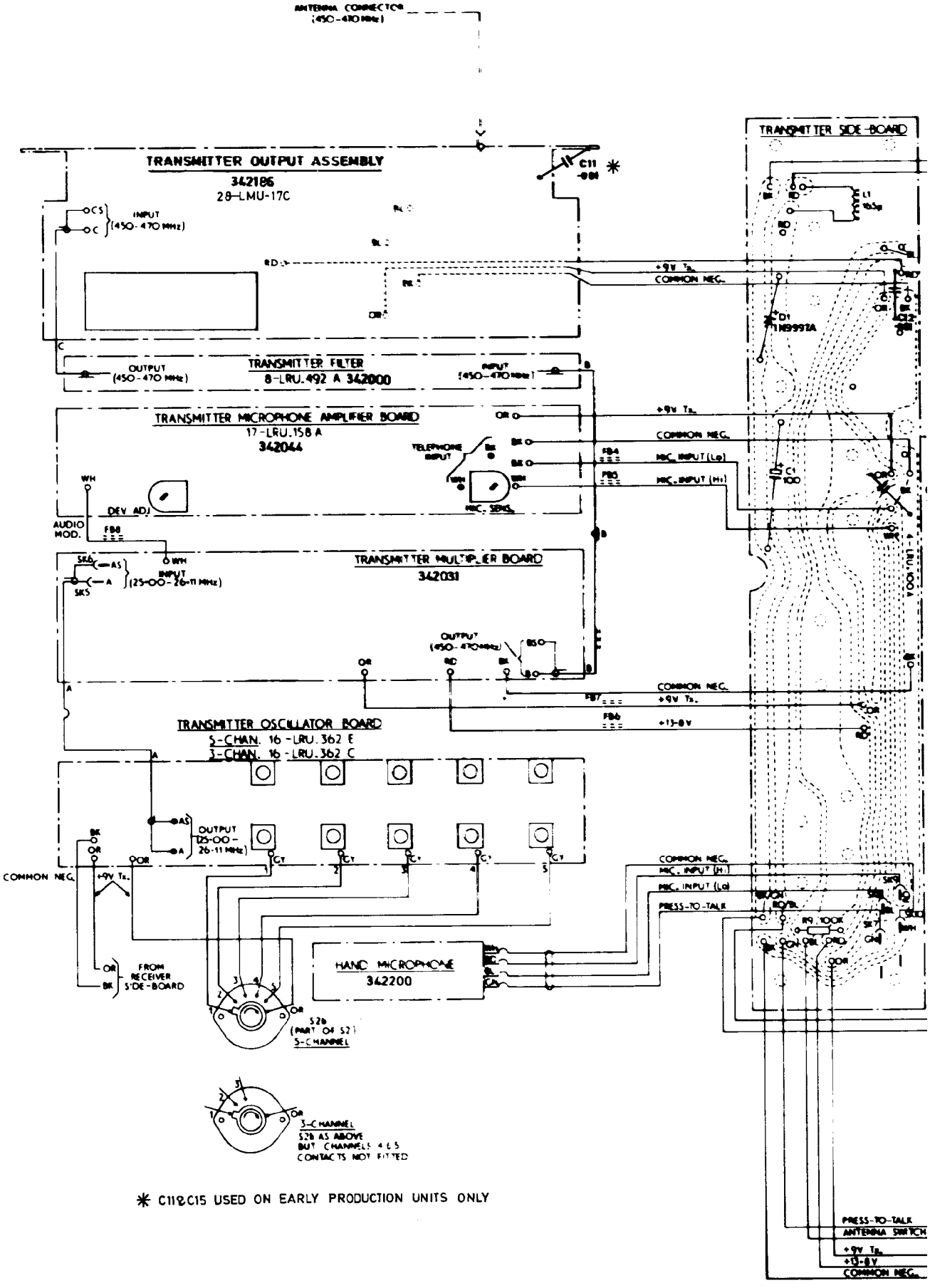
FIG 25



3/5 CHANNEL 400 – 420 MHz

INTERCONNEXION DIAGRAM
MULTI-CHANNEL

FIG. 25



* C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY

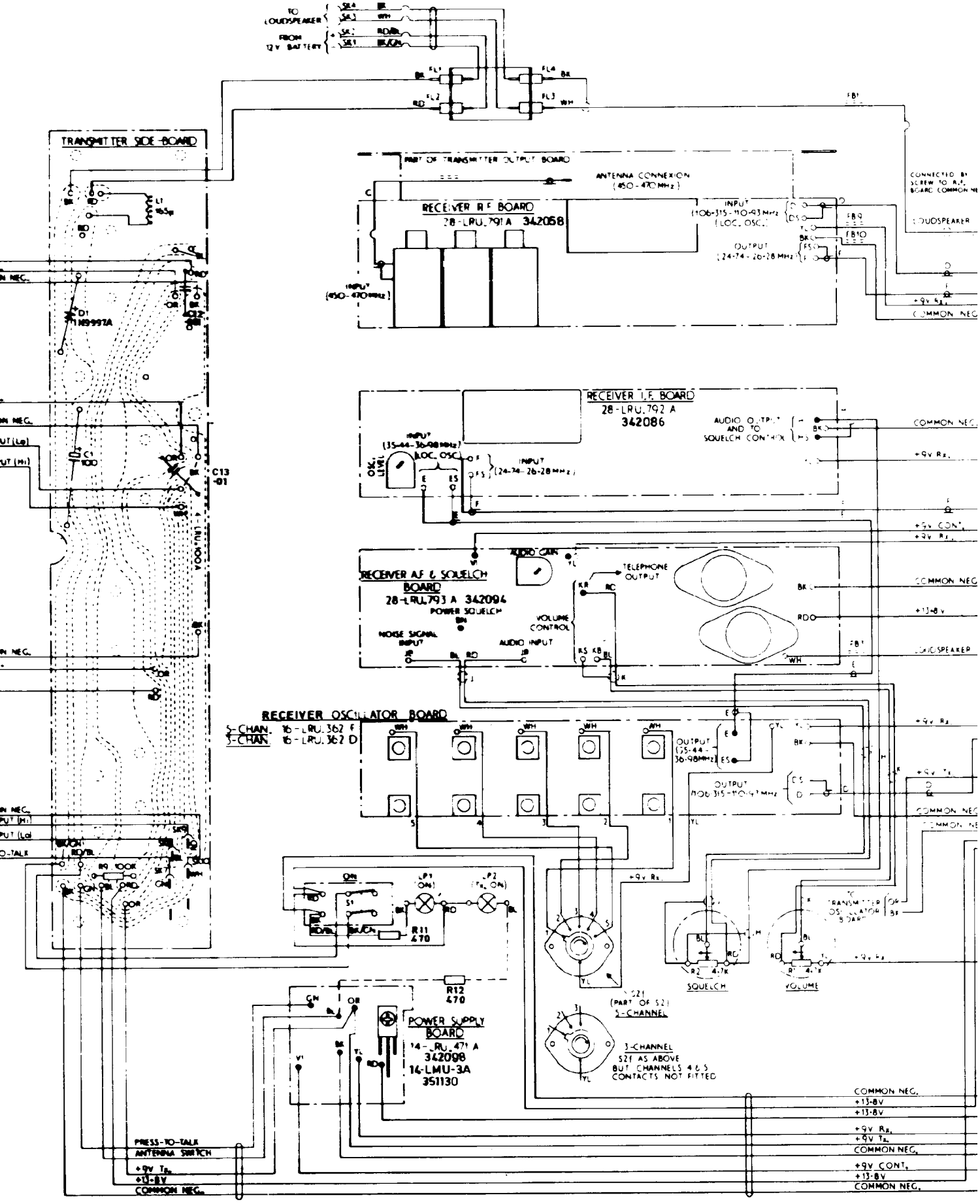


FIG. 26

3/5 CHANNEL
450-470 MHz

INTERCONNEXION DIAGRAM
MULTI-CHANNEL

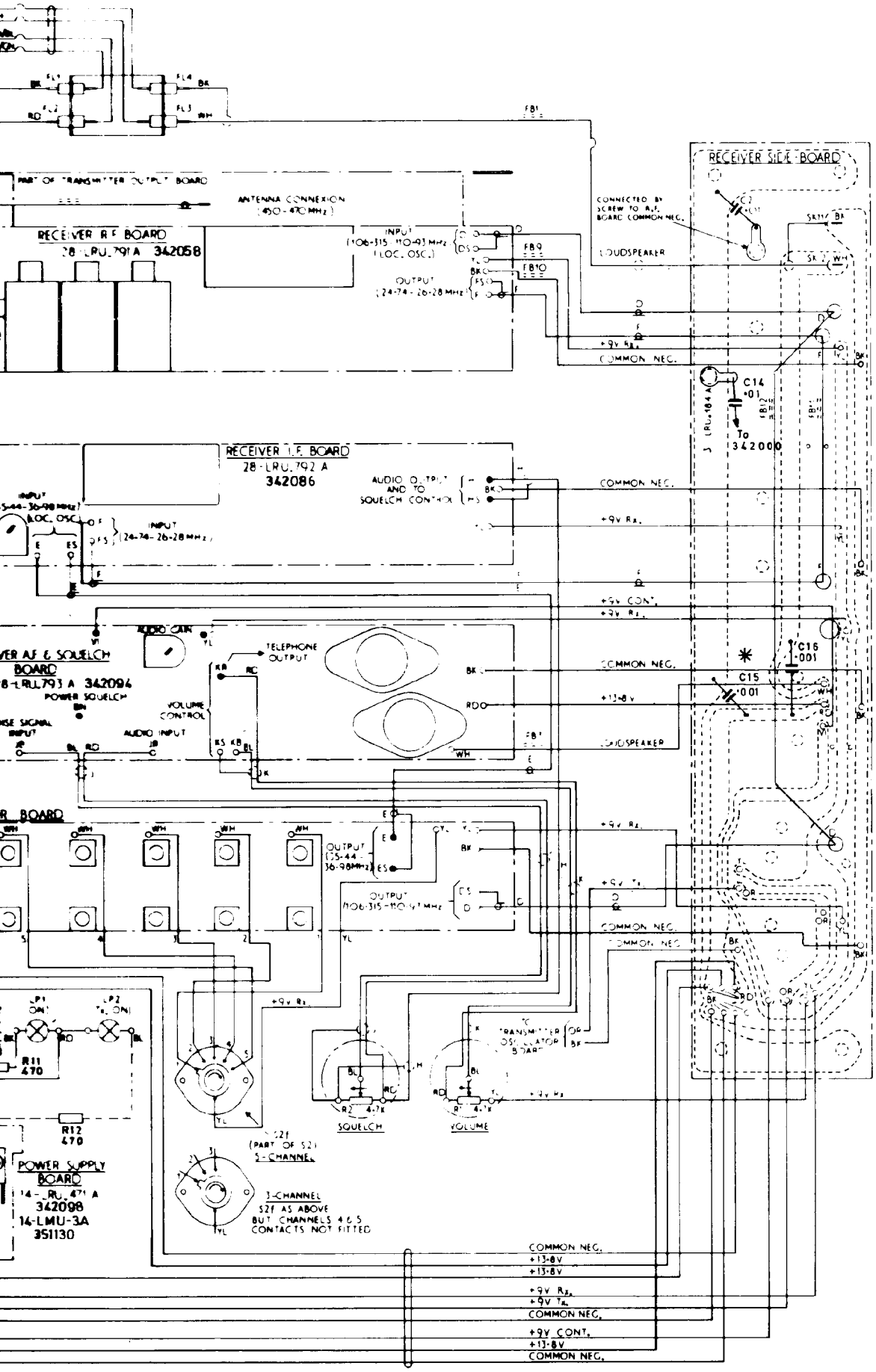
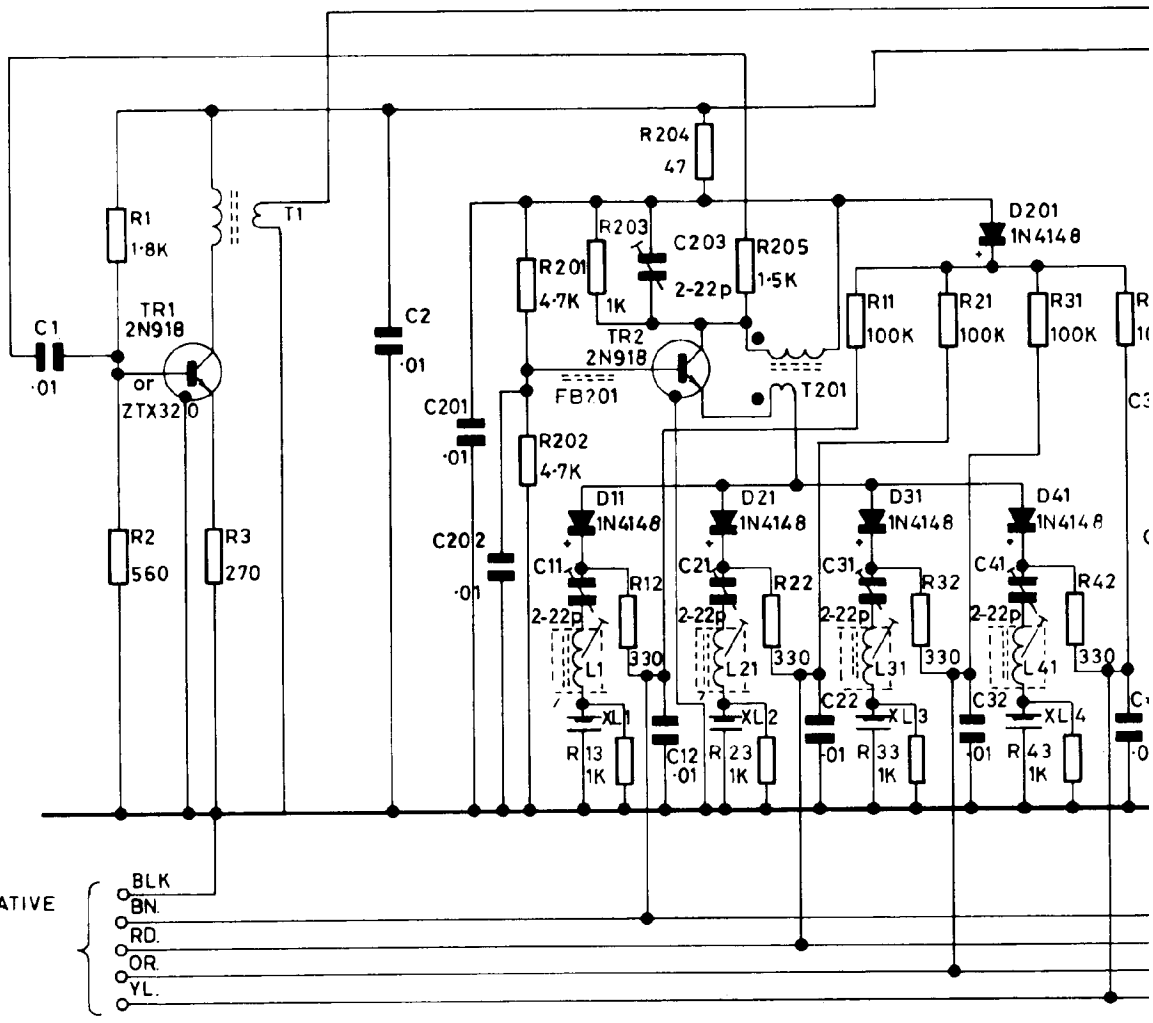


FIG. 26

FREQ.			400 - 420 MHz		450 - 470 MHz		
SCHEM. REF.	342187	342188	342189	342190	342191	342192	342193
	GROUP A	GROUP B	GROUP C	GROUP D	GROUP E	GROUP F	GROUP G
R401	3·3K	4·7K	4·7K	3·3K	3·3K	3·3K	3·3K
R402	560	1K	1K	560	560	560	560
R403	150	100	100	150	150	150	150
C503			10p.	9p.	7·5p.	9p.	7·5p.
C504			12p.	10p.	9p.	10p.	9p.

RESISTORS	1 2 3 201 202 203 12 13 204 205 22 23 11 21 32 33 31 42 43 41
CAPACITORS	1 2 201 202 11 203 12 21 22 31 32 41 42
MISCELLANEOUS	TR1 T1 TR2 FB201 L1 XL1 L21 XL2 T201 L31 XL3 L41 XL4
DIODES	11 21 31 41



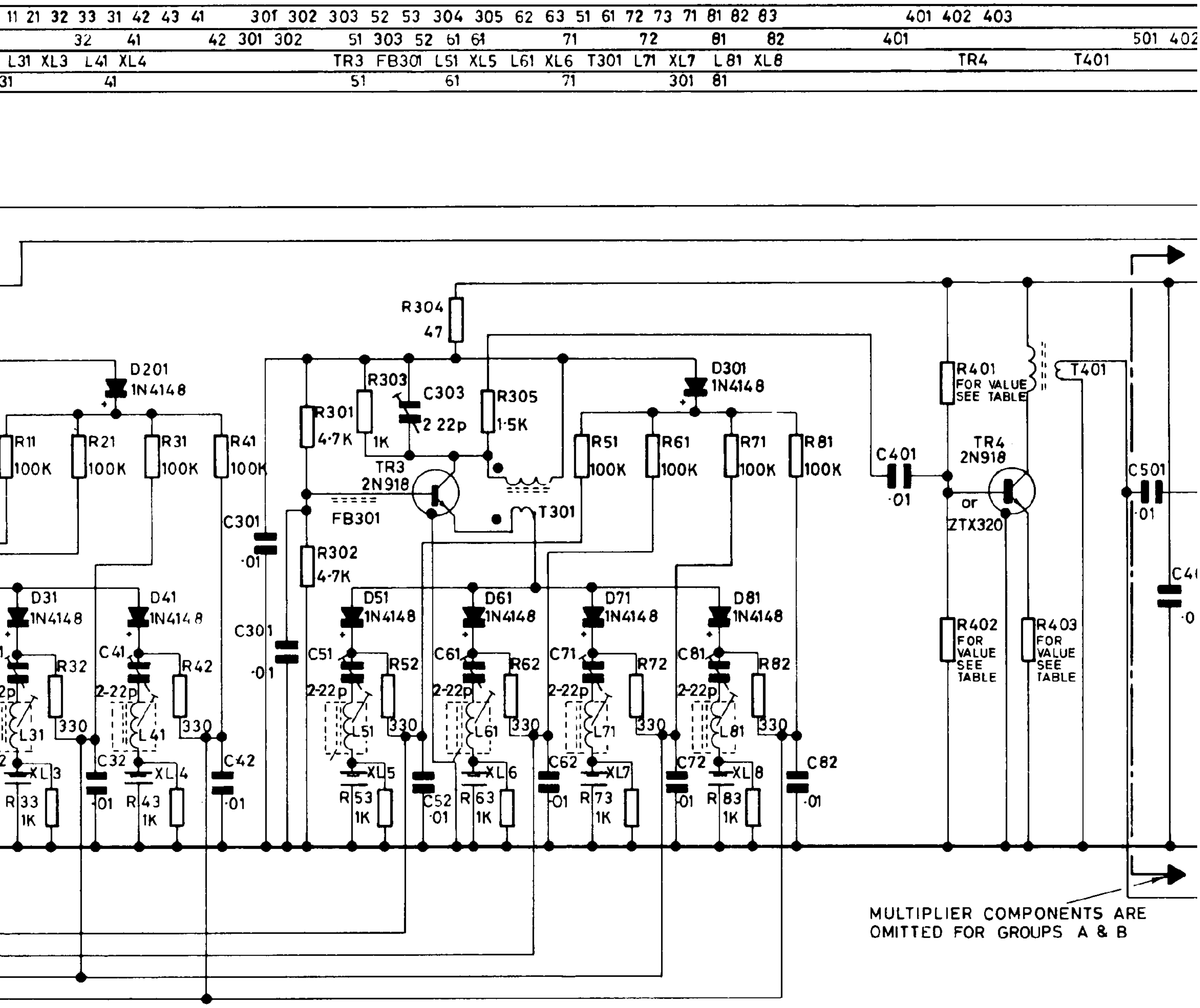


FIG. 27

342187/93

OSCILLATOR BOARD 4CHANNEL

16-LMU-8. A-G

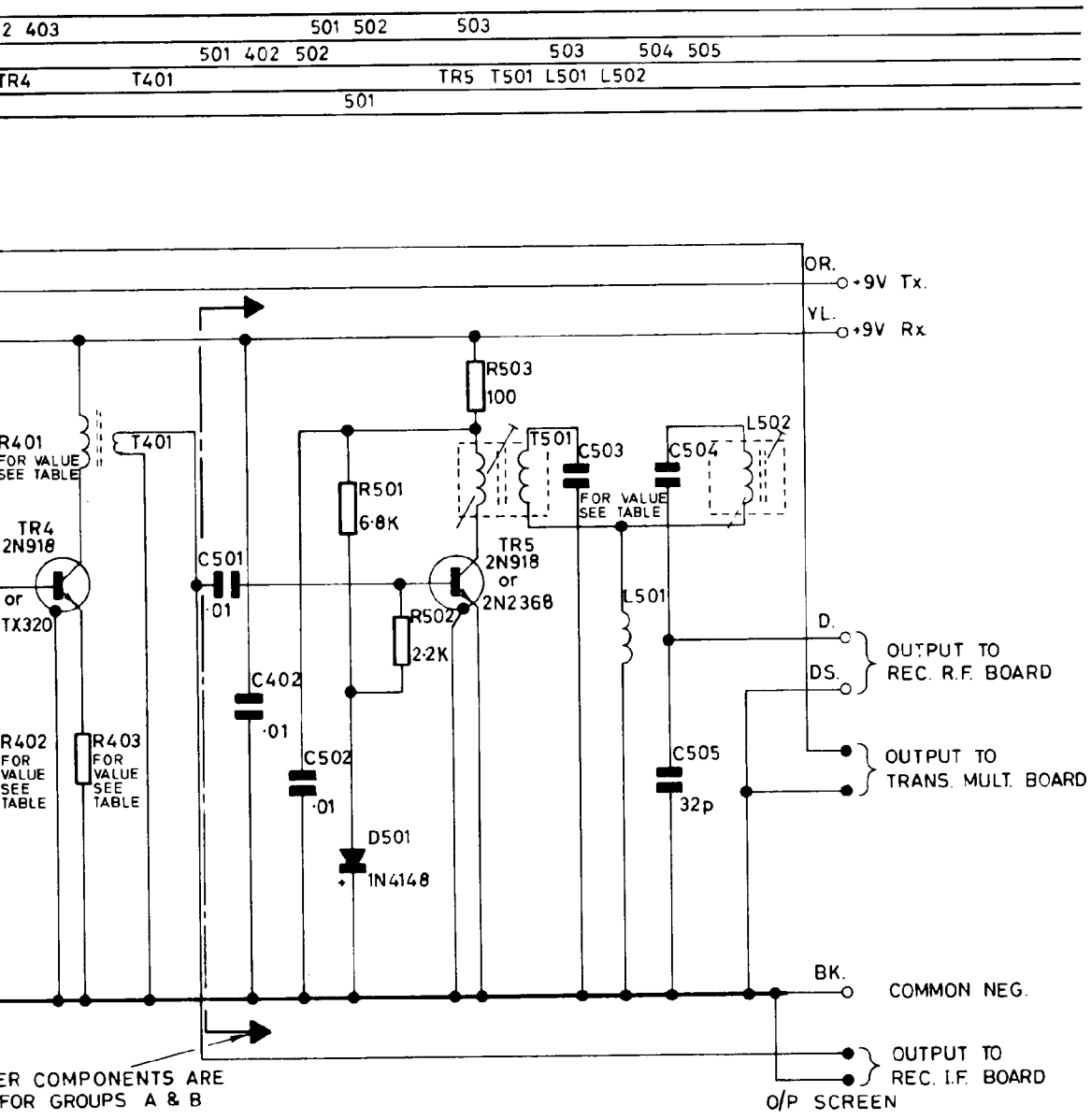
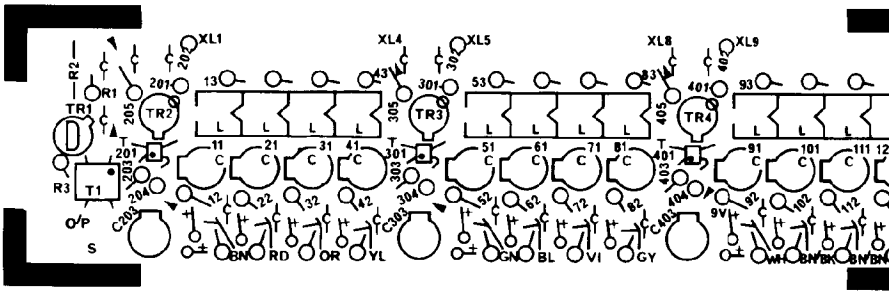


FIG. 27

FREQ	400-512MHz	450-470MHz	400-420MHz	400-512MHz	450-470MHz	400-420MHz
UNIT	TRANSMITTER RECEIVER		RECEIVER	TRANSMITTER RECEIVER		RECEIVER
SCHEM REF	12 CHANNEL			8 CHANNEL		
	342126	342127	342128	342129	342130	342131
	GROUP A	GROUP B	GROUP C	GROUP E	GROUP F	GROUP G
R1	5·8K	10K	10K	3·3K	4·7K	4·7K
R2	2·2K	2·2K	2·2K	1K	1K	1K
R3	270	150	100	270	150	100

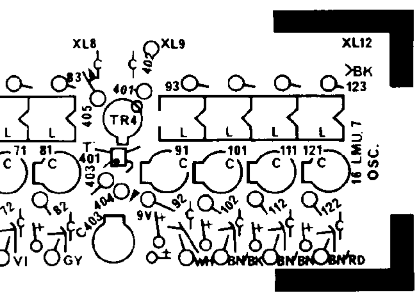
p.c.b. Component Code actual size.

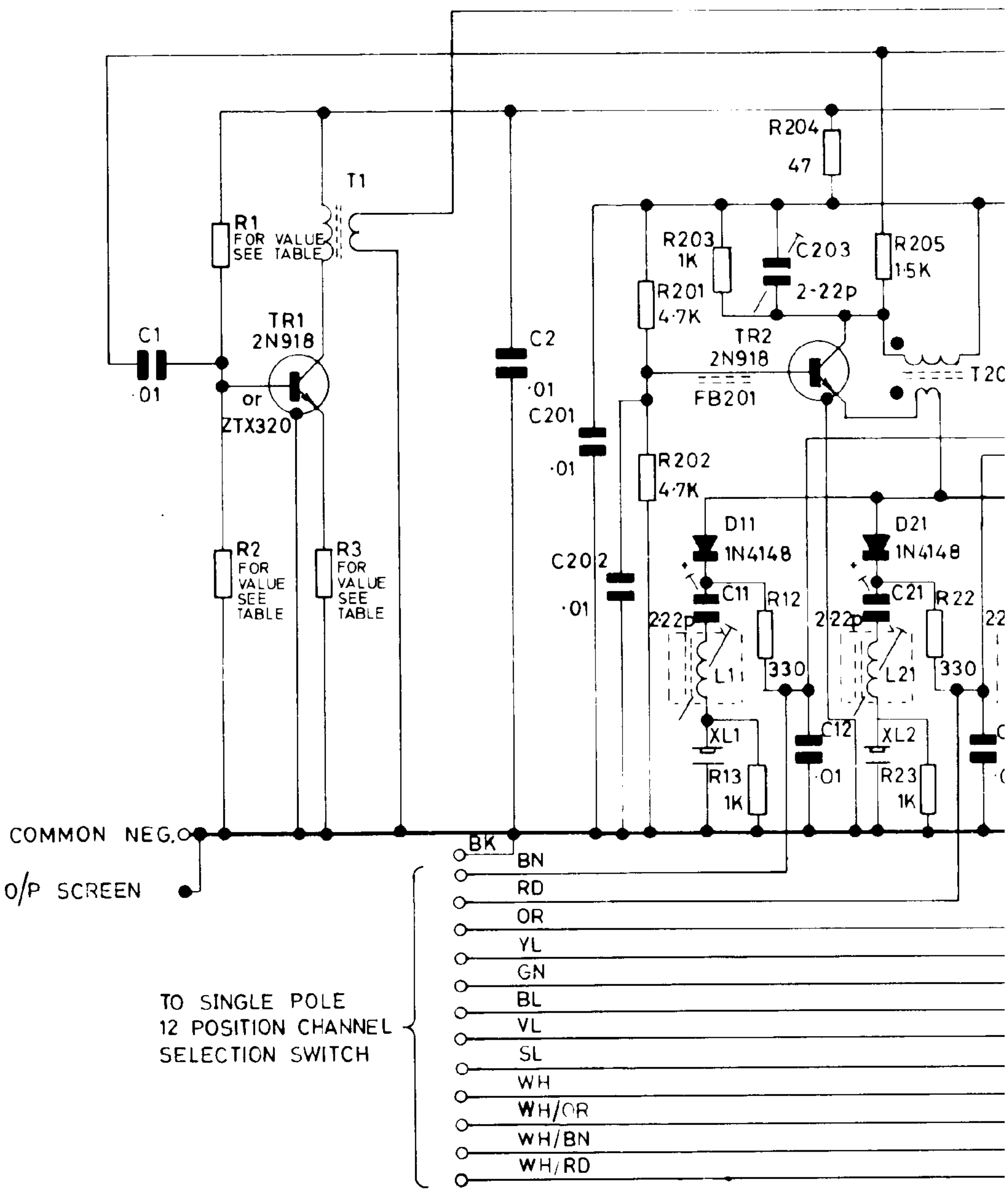


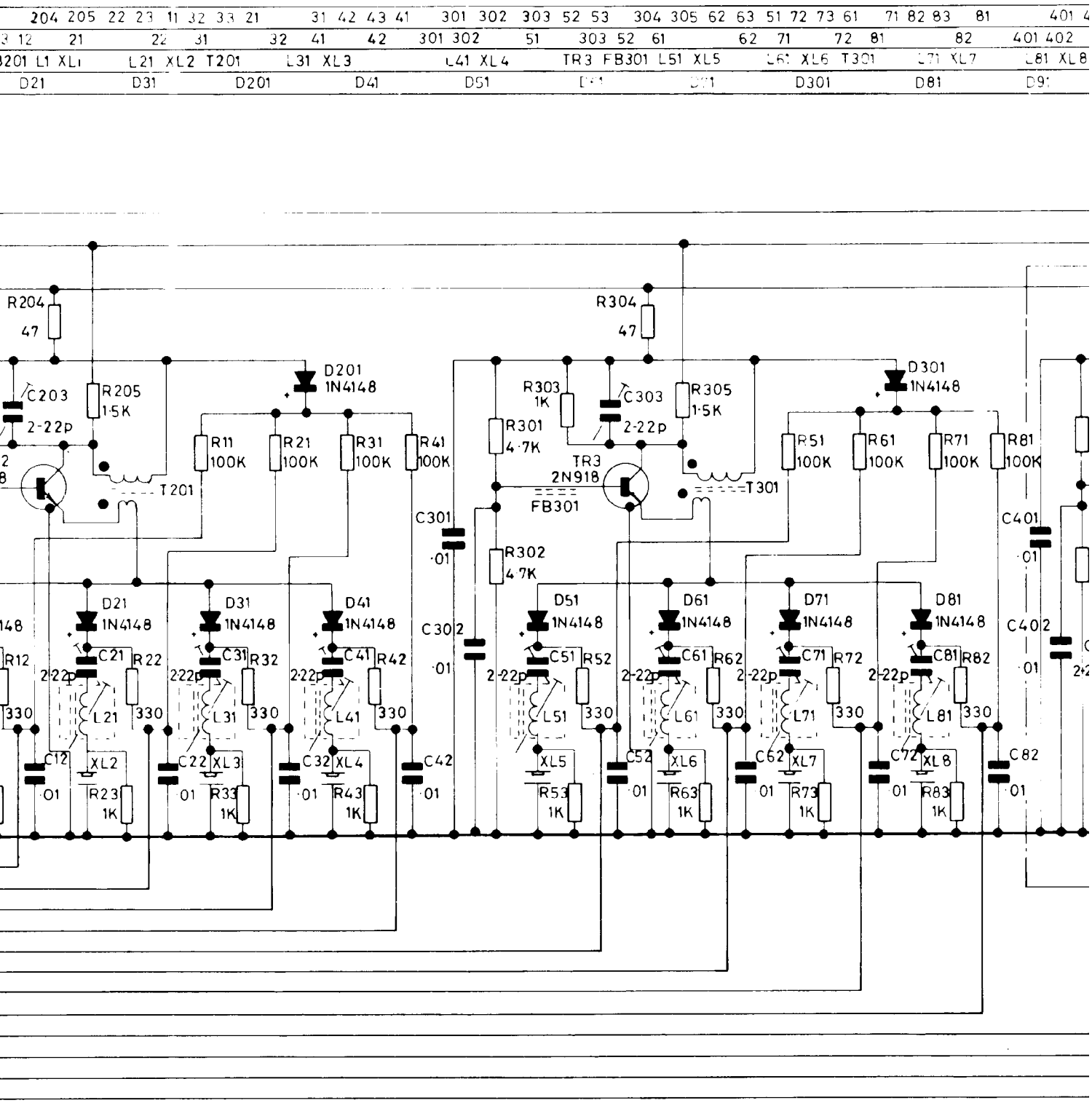
400-420MHz
RECEIVER
342131
GROUP G
4·7K
1K
100

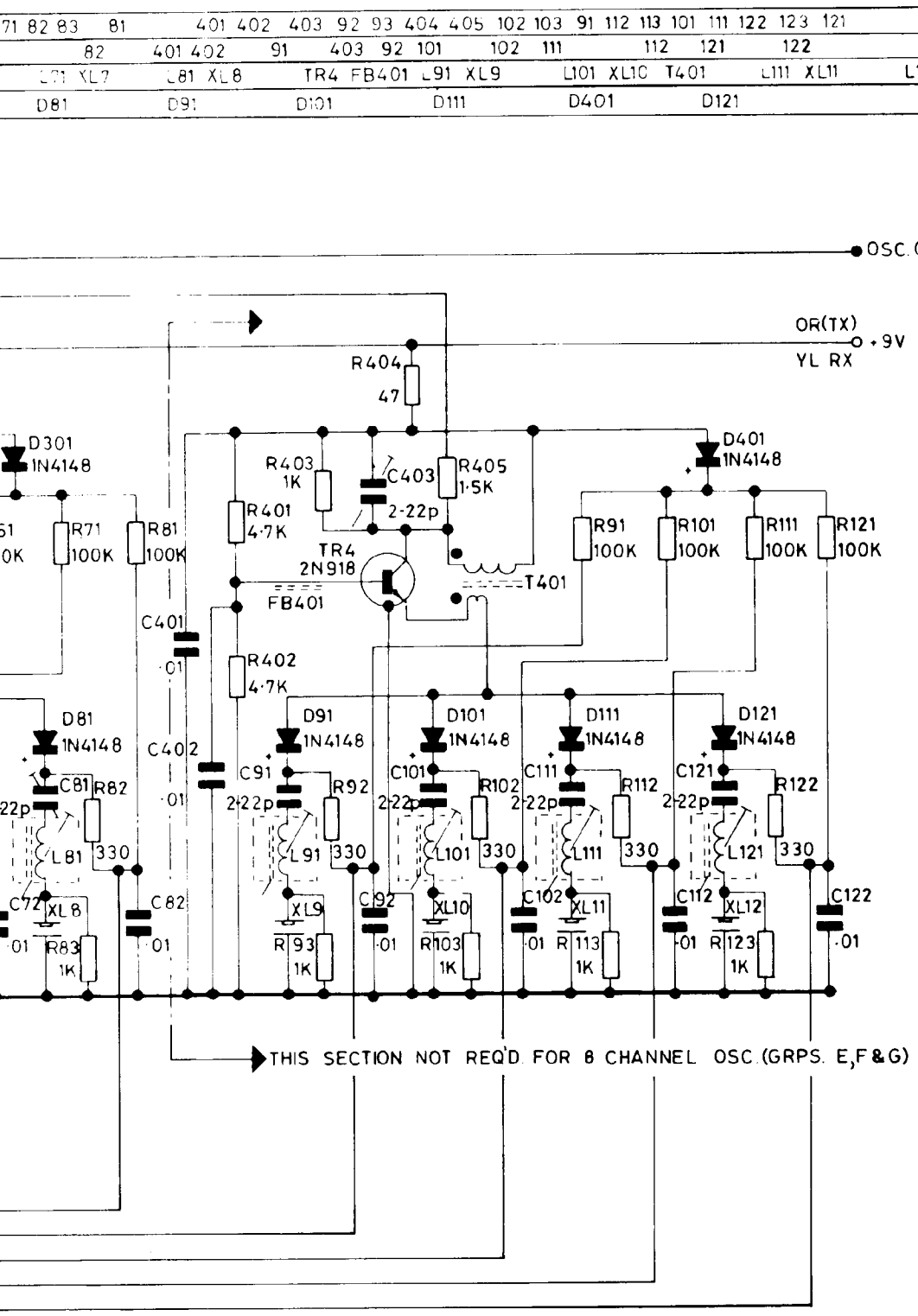
RESISTORS	1 2 3 201 202 203 12 13 204 205 22 23 11
CAPACITORS	1 2 201 202 11 203 12 21 22
MISCELLANEOUS	TR1 T1 TR2 FB201 L1 XL1 L21 XL
	D11 D21 D31

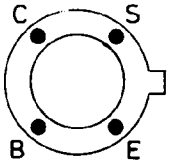
al size.







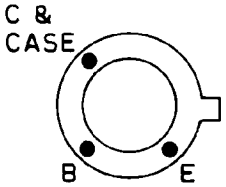




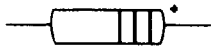
2N918 TR1

TABLE 1

DP N°	GROUP	C3 VALUE	C4 VALUE
342461	A	10p	12p
	B	9p	10p
342185	C	7·5p	9p
	D	9p	10p
	E	7·5p	9p



2N2368 TR1 (ALTERNATIVE)
* EARTH CONNECTION ON BOARD NOT USED



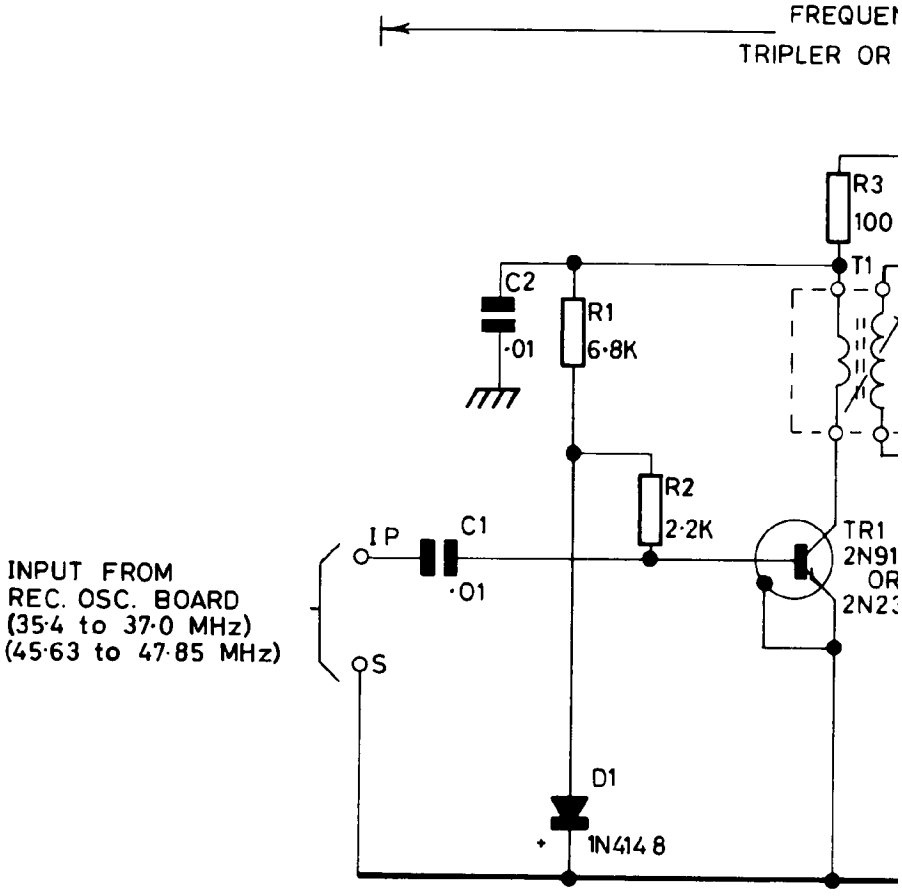
1N4148 D1

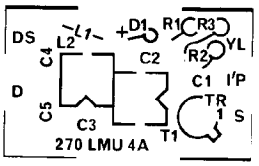
BANDS OR RED SPOTS DENOTE CATHODE

RESISTORS				1	2		3
CAPACITORS	1	2					
MISCELLANEOUS				D1		TR1	T1

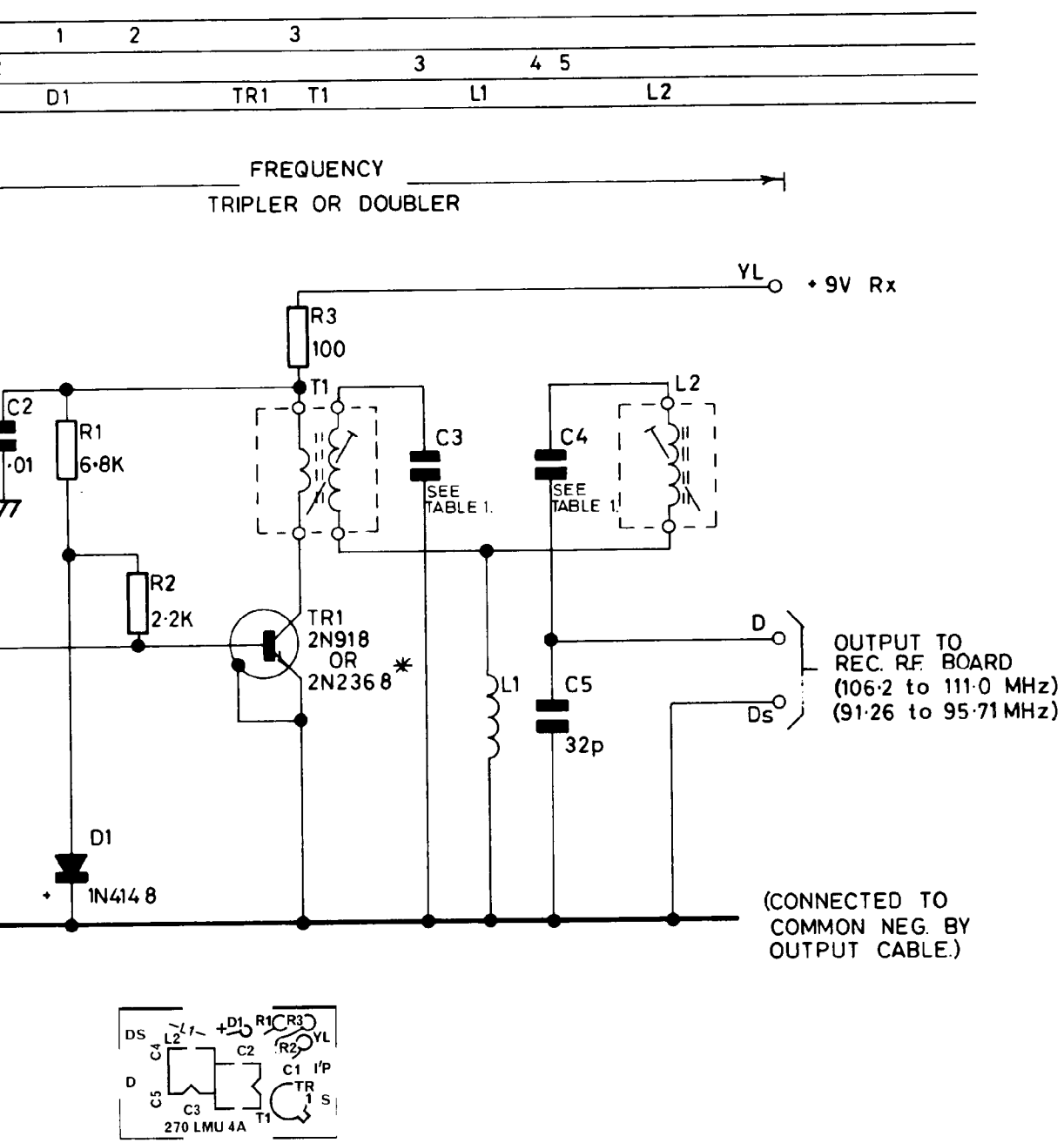
ABLE 1

VALUE	C4 VALUE
10p	12p
9p	10p
7·5p	9p
9p	10p
7·5p	9p

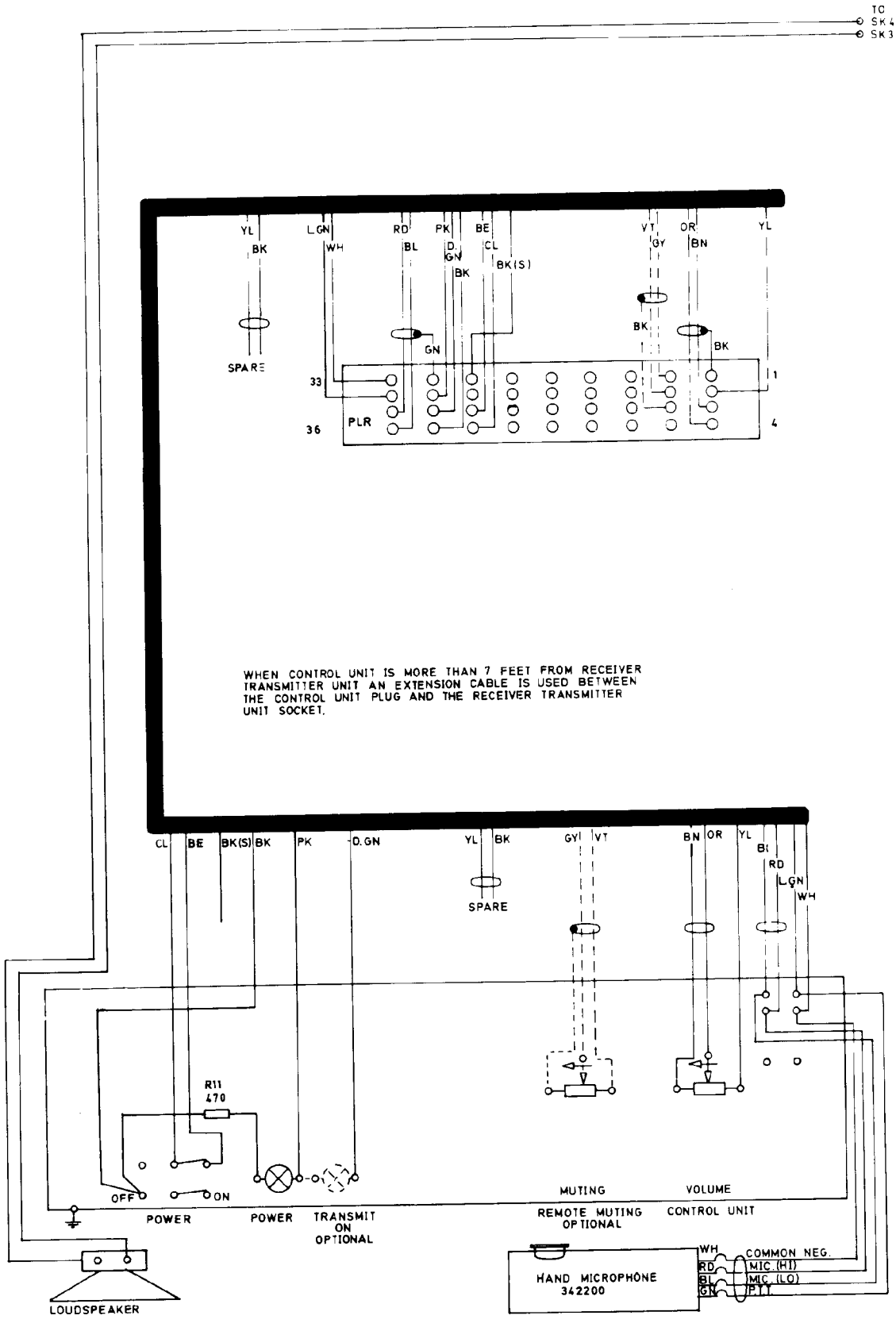




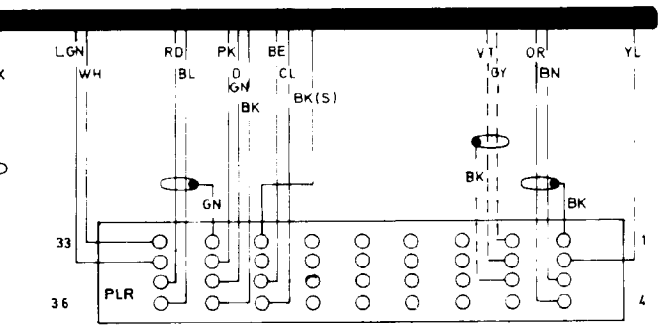
p.c.b. Component Code actual



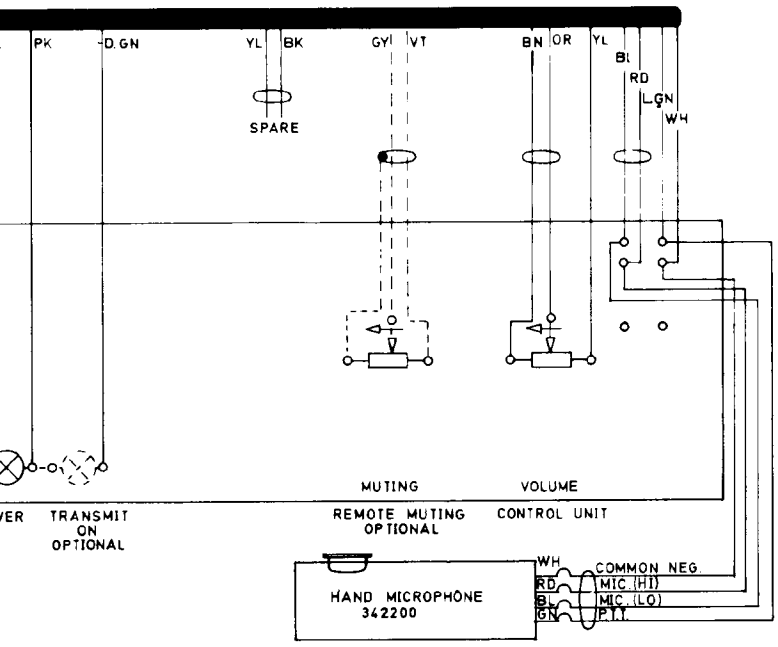
p.c.b. Component Code actual size.



NOTE 2 SHIELDS OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE UNLESS SO SPECIFIED



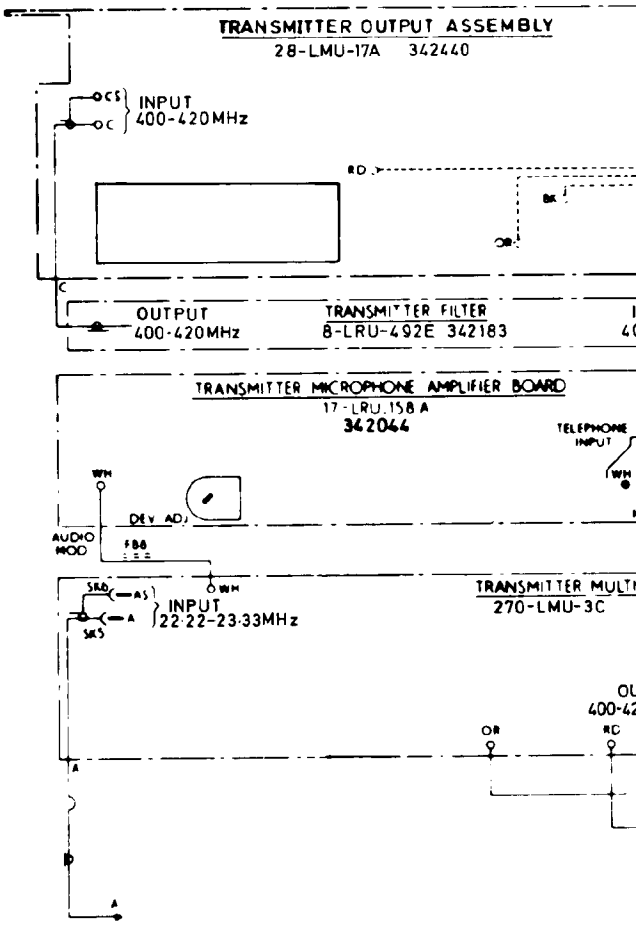
N CONTROL UNIT IS MORE THAN 7 FEET FROM RECEIVER
NSMITTER UNIT AN EXTENSION CABLE IS USED BETWEEN
CONTROL UNIT PLUG AND THE RECEIVER TRANSMITTER
SOCKET.

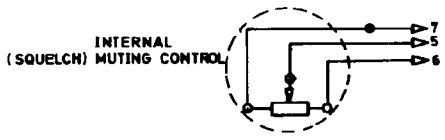


F CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE
SPECIFIED

TO
SK4
SK3

ANTENNA CONNECTOR
400-420 MHz





WHEN INTERNAL MUTING IS USED THE MUTING POTENTIOMETEI
IS CONNECTED TO THE UNIT SOCKET SKR AS SHOWN ABOVI

✳ C11 & C15 USED ON EARLY PRODUCTION UNITS
IN CURRENT EQUIPMENT THE SOCKET SKR & PLUG PLR ARI
2 ROW 25 PAIR ARRANGEMENT. PIN NUMBERING IS CONSISTAN

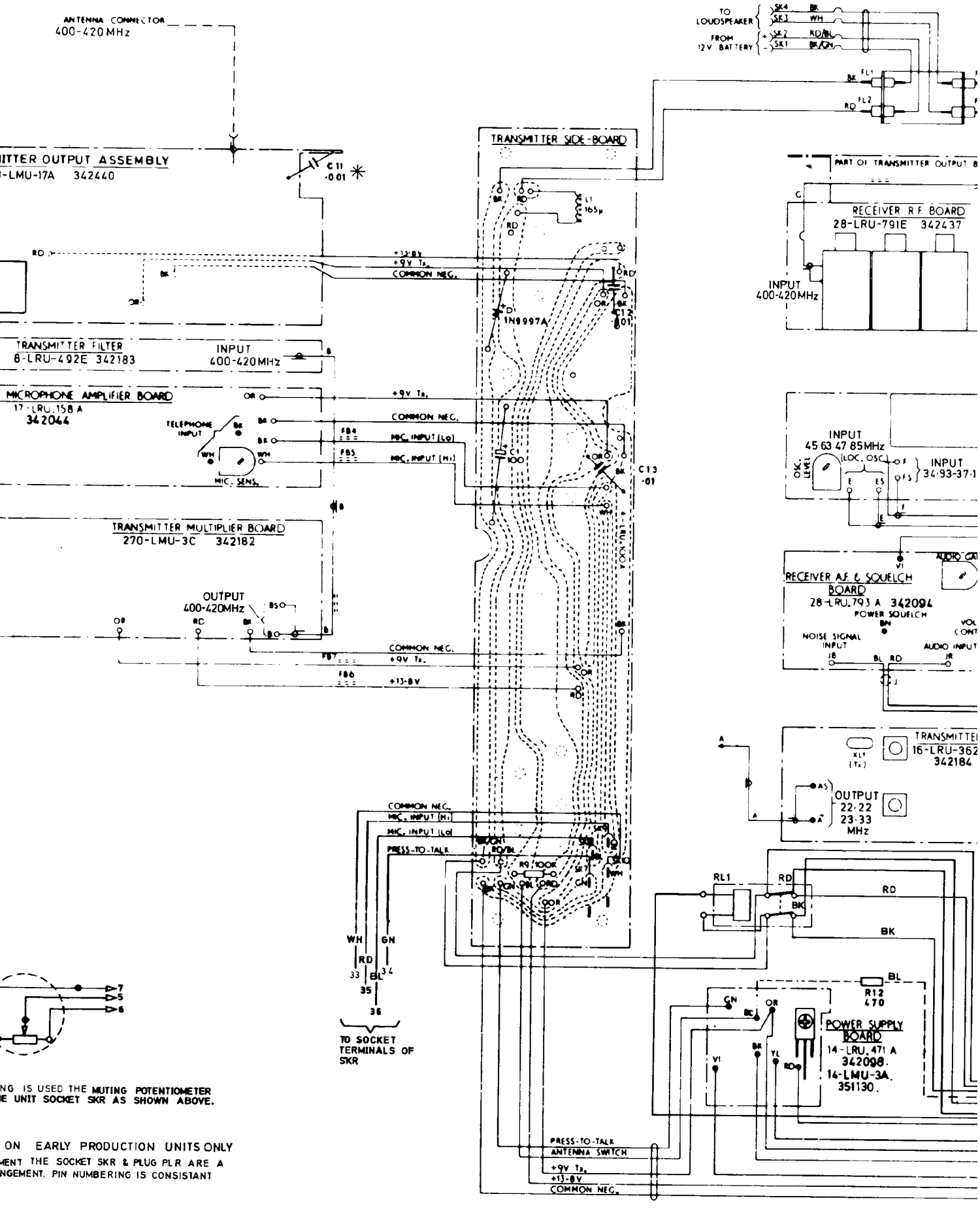


FIG. 30

INTERCONNEXION DIAGRAM
SINGLE-CHANNEL (WITH EXTENDED CONTROL UNIT)

400-420MHz

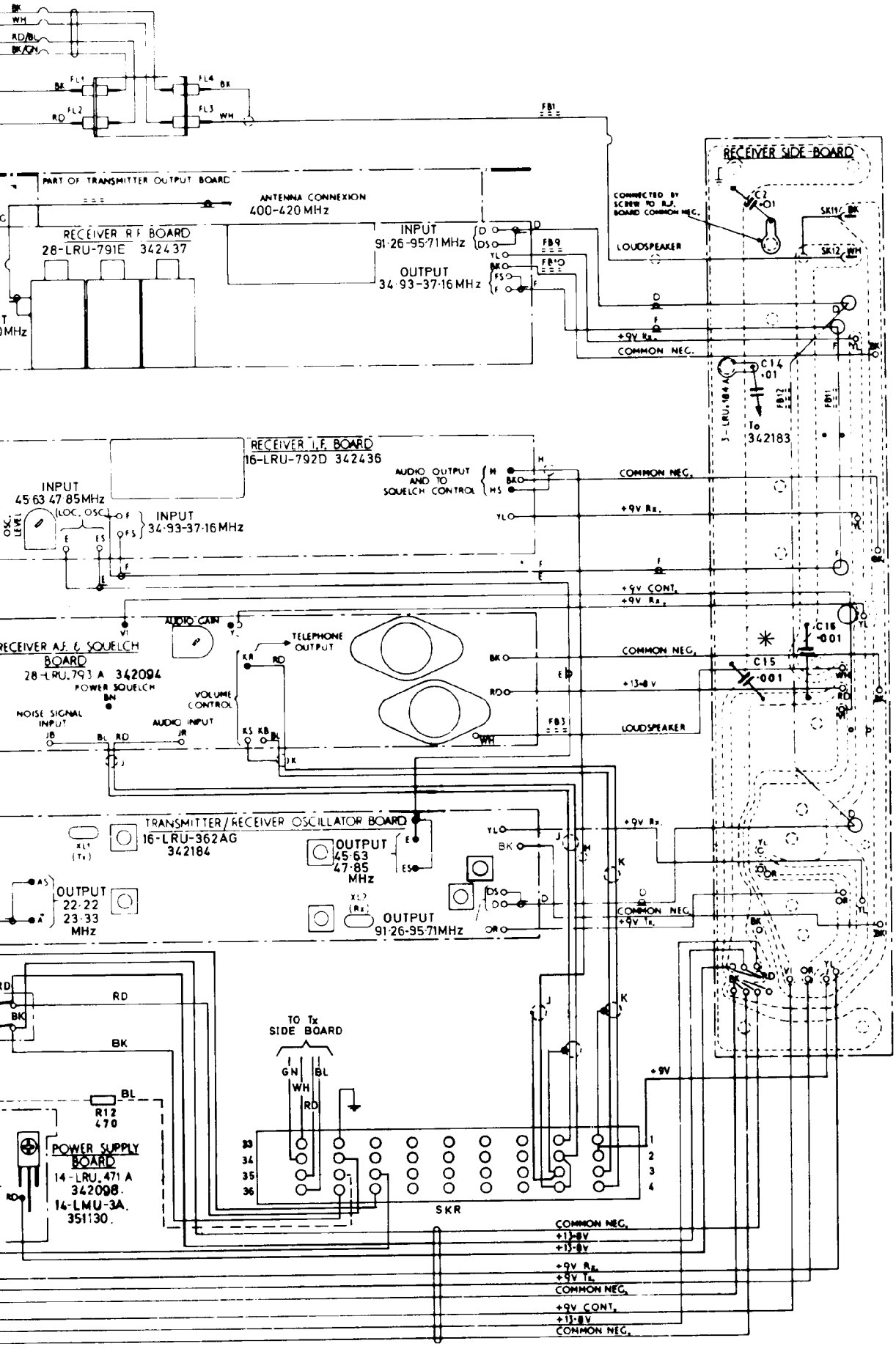
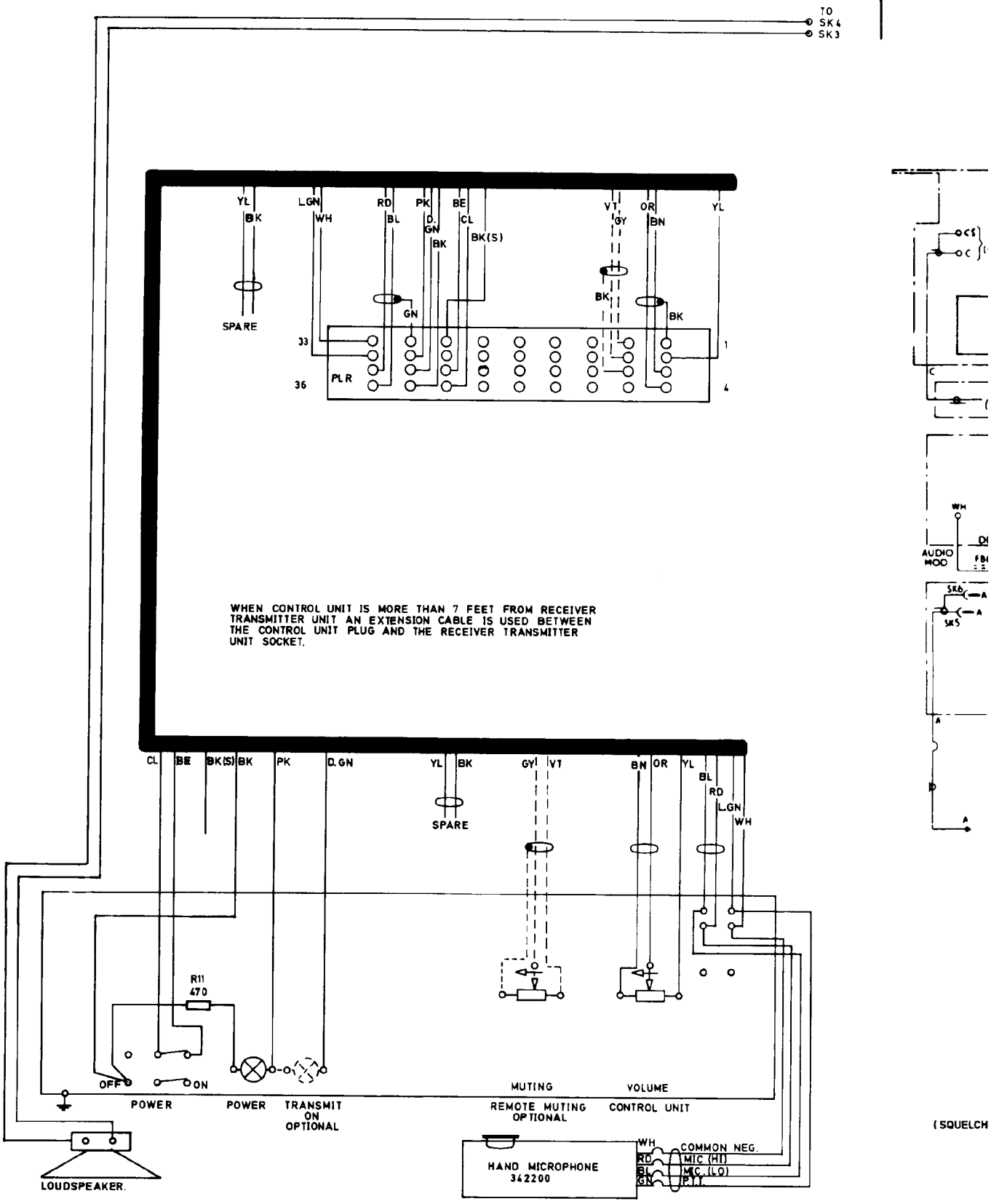
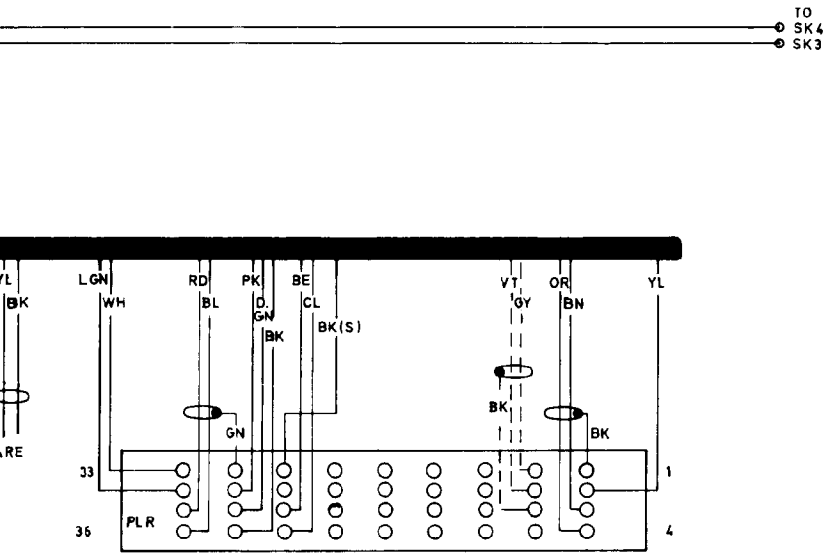


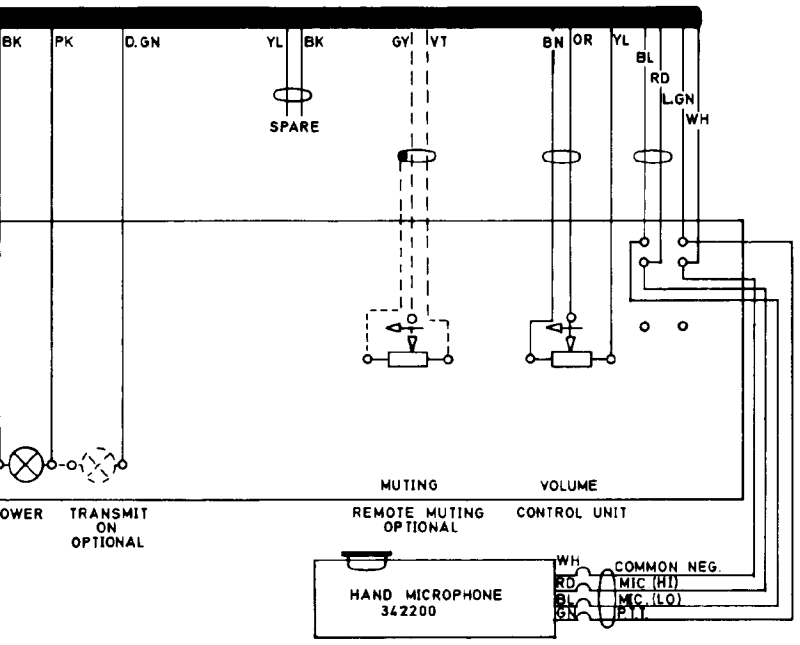
FIG. 30



NOTE 2 SHIELDS OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE UNLESS SO SPECIFIED

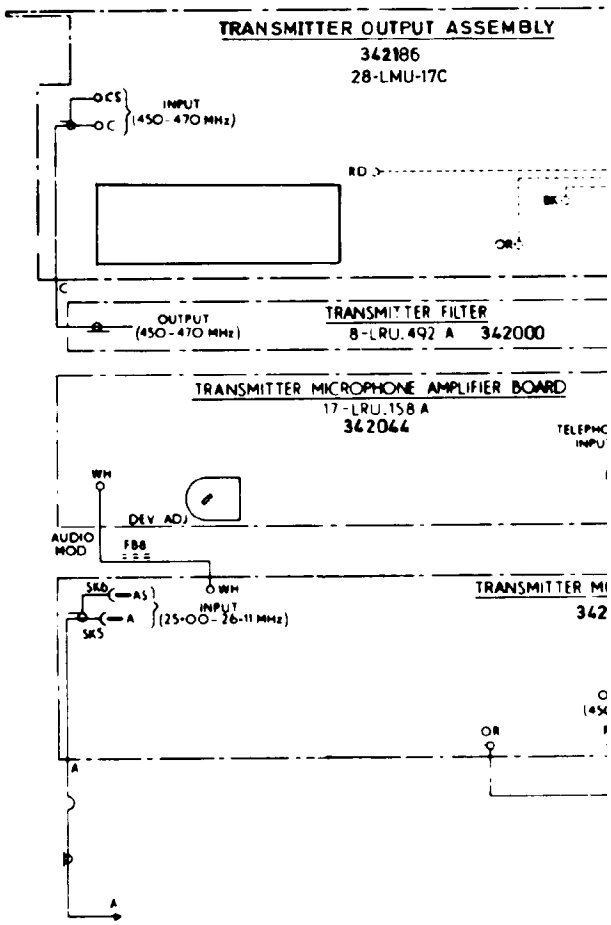


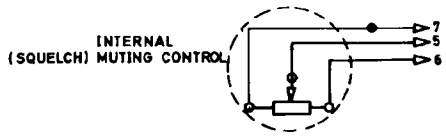
WHEN CONTROL UNIT IS MORE THAN 7 FEET FROM RECEIVER
RANSMITTER UNIT AN EXTENSION CABLE IS USED BETWEEN
HE CONTROL UNIT PLUG AND THE RECEIVER TRANSMITTER
NIT SOCKET.



OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE
SO SPECIFIED

ANTENNA CONNECTOR
(450-470 MHz)





WHEN INTERNAL MUTING IS USED THE MUTING POTENTIOM
IS CONNECTED TO THE UNIT SOCKET SKR AS SHOWN AE

* C11 & C15 USED ON EARLY PRODUCTION UNITS O

IN CURRENT EQUIPMENT THE SOCKET SKR & PLUG PLR AF
2 ROW 25 PAIR ARRANGEMENT. PIN NUMBERING IS CONSIS

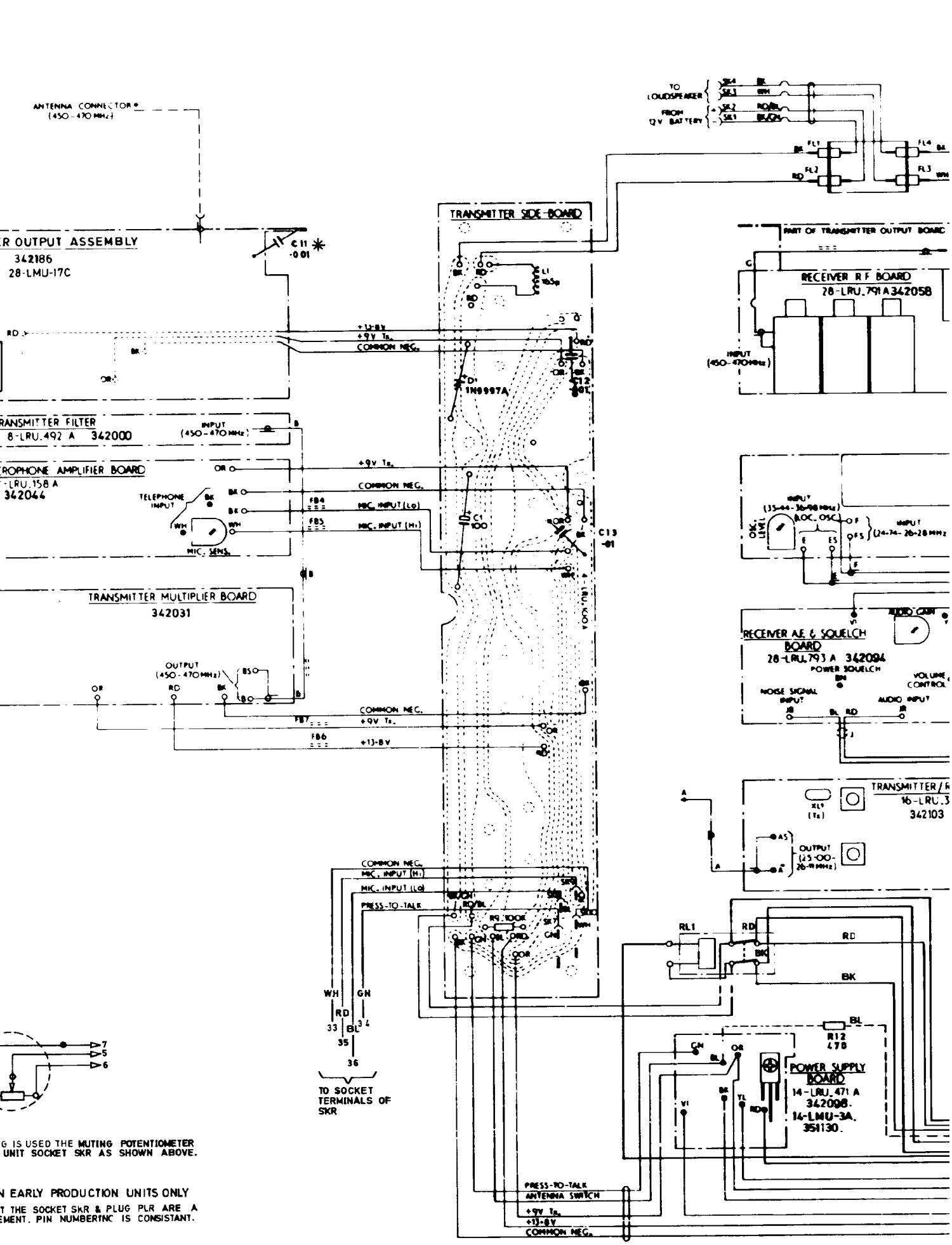


FIG. 31

INTERCONNEXION DIAGRAM
SINGLE-CHANNEL (WITH EXTENDED CONTROL UNIT)

450-470 MHz

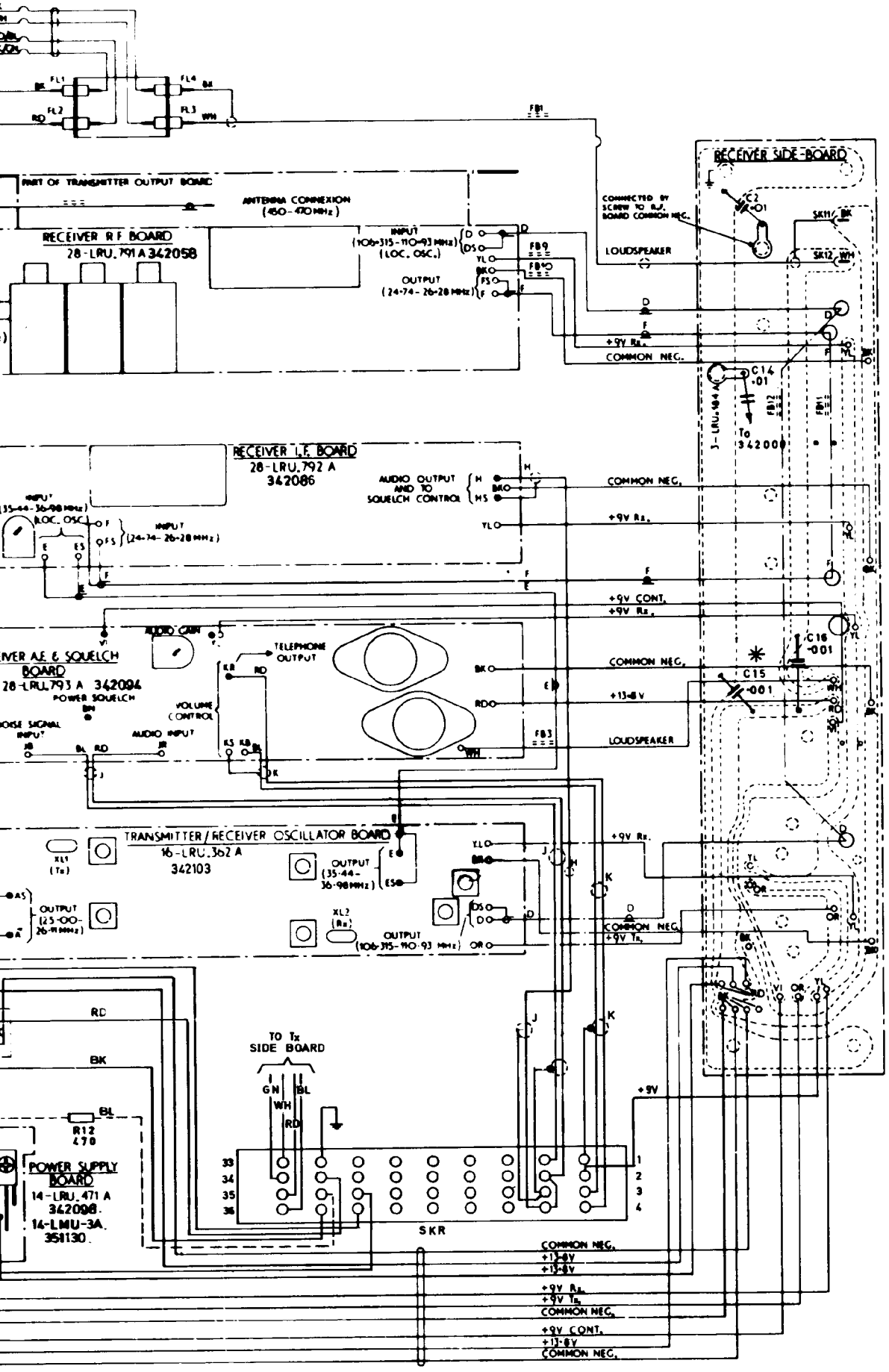
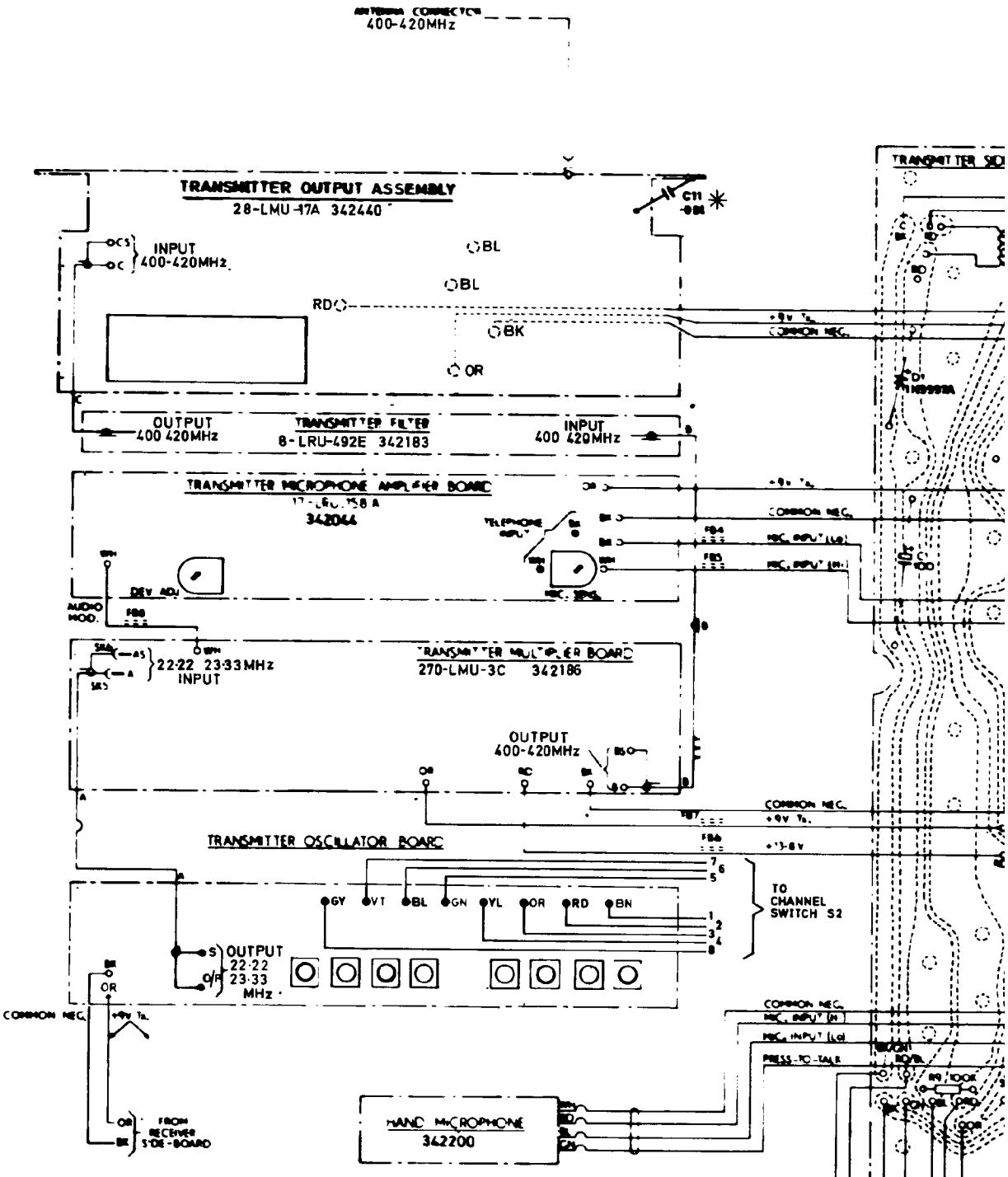


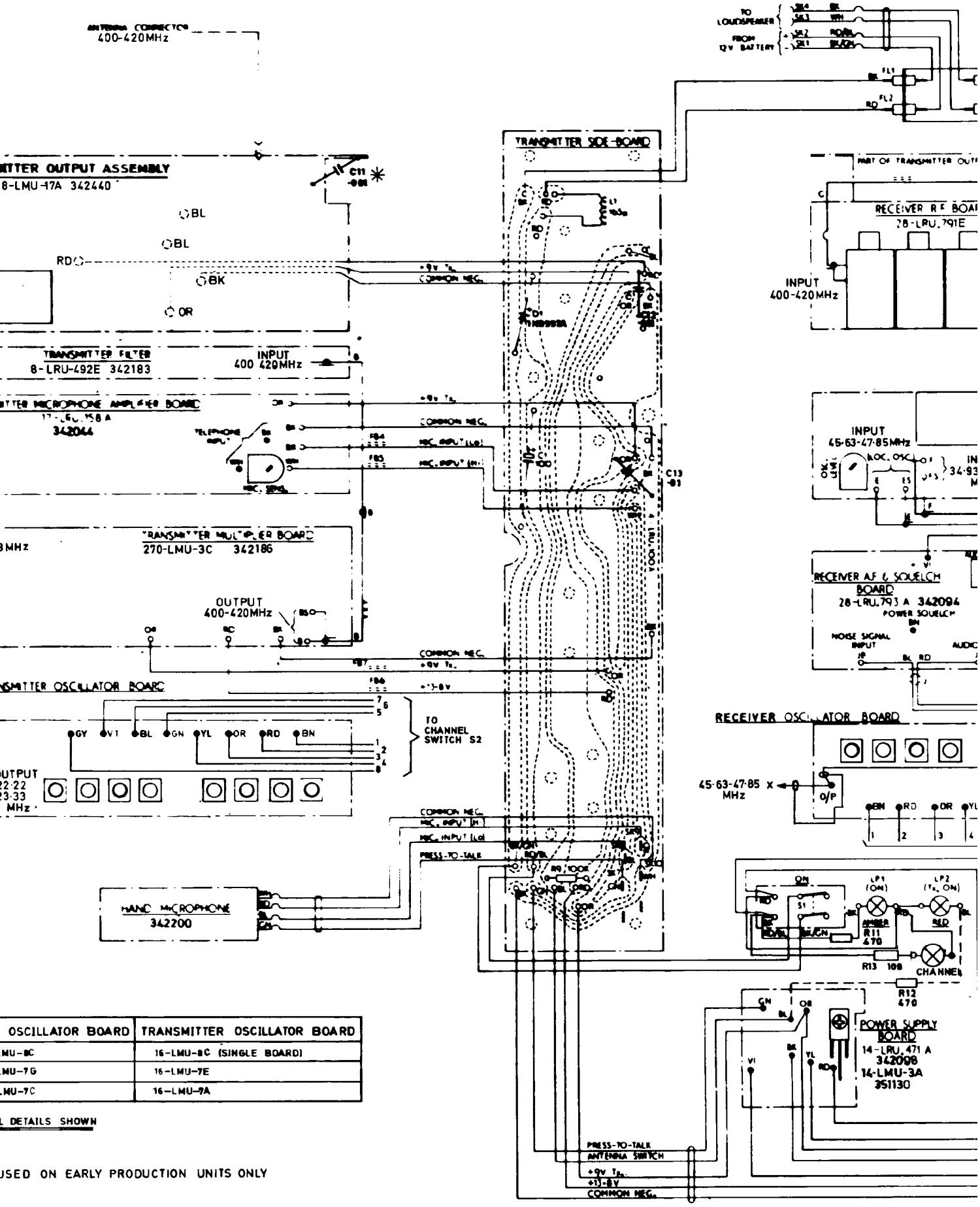
FIG. 31



	RECEIVER OSCILLATOR BOARD	TRANSMITTER OSCILLATOR BOARD
4 CHANNEL	16-LMU-8C	16-LMU-8C (SINGLE BOARD)
8 CHANNEL	16-LMU-7G	16-LMU-7E
12 CHANNEL	16-LMU-7C	16-LMU-7A

8 CHANNEL DETAILS SHOWN

* C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY

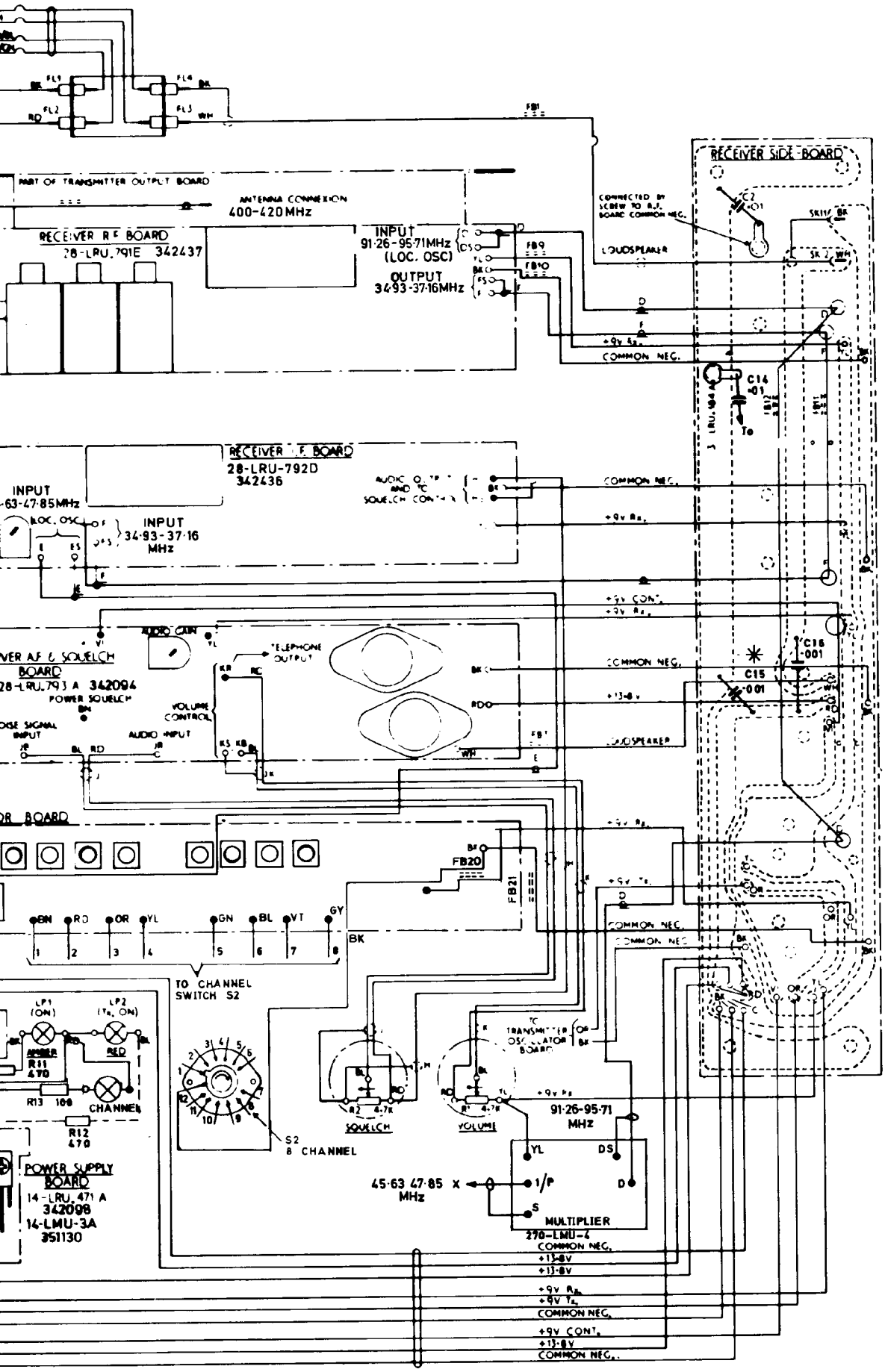


OSCILLATOR BOARD	TRANSMITTER OSCILLATOR BOARD
LMU-8C	16-LMU-8C (SINGLE BOARD)
LMU-7G	16-LMU-7E
LMU-7C	16-LMU-7A

L DETAILS SHOWN

USED ON EARLY PRODUCTION UNITS ONLY

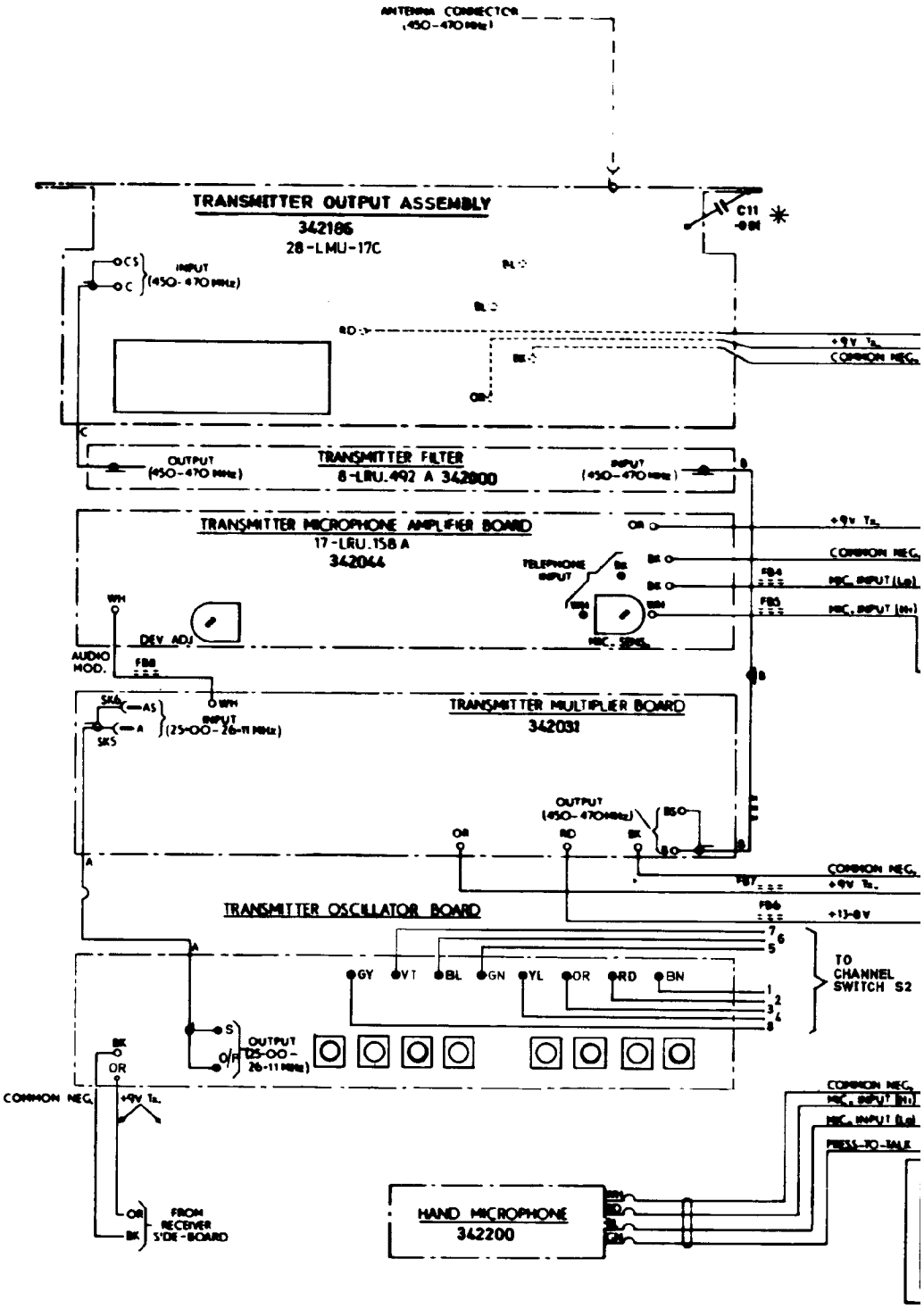
FIG. 32



INTERCONNEXION DIAGRAM
MULTI-CHANNEL

400-420MHz

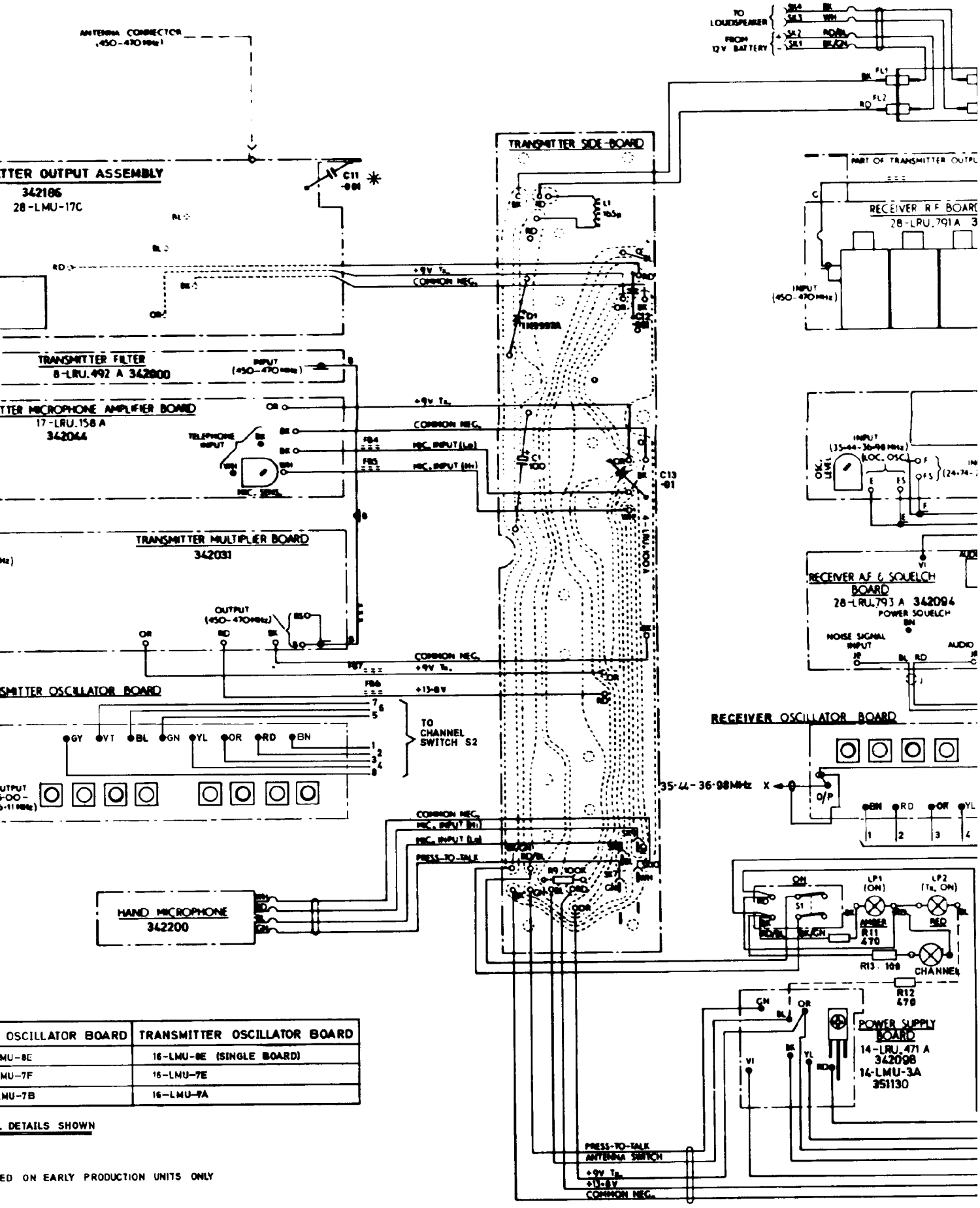
FIG. 32



	RECEIVER OSCILLATOR BOARD	TRANSMITTER OSCILLATOR BOARD
4 CHANNEL	16-LMU-8E	16-LMU-8E (SINGLE BOARD)
8 CHANNEL	16-LMU-7F	16-LMU-7E
12 CHANNEL	16-LMU-7B	16-LMU-9A

8 CHANNEL DETAILS SHOWN

* C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY



OSCILLATOR BOARD	TRANSMITTER OSCILLATOR BOARD
MU-8E	16-LMU-8E (SINGLE BOARD)
MU-7F	16-LMU-7E
MU-7B	16-LMU-7A

. DETAILS SHOWN

ED ON EARLY PRODUCTION UNITS ONLY

FIG. 33

450–470 MHz

INTERCONNEXION DIAGRAM
MULTI-CHANNEL

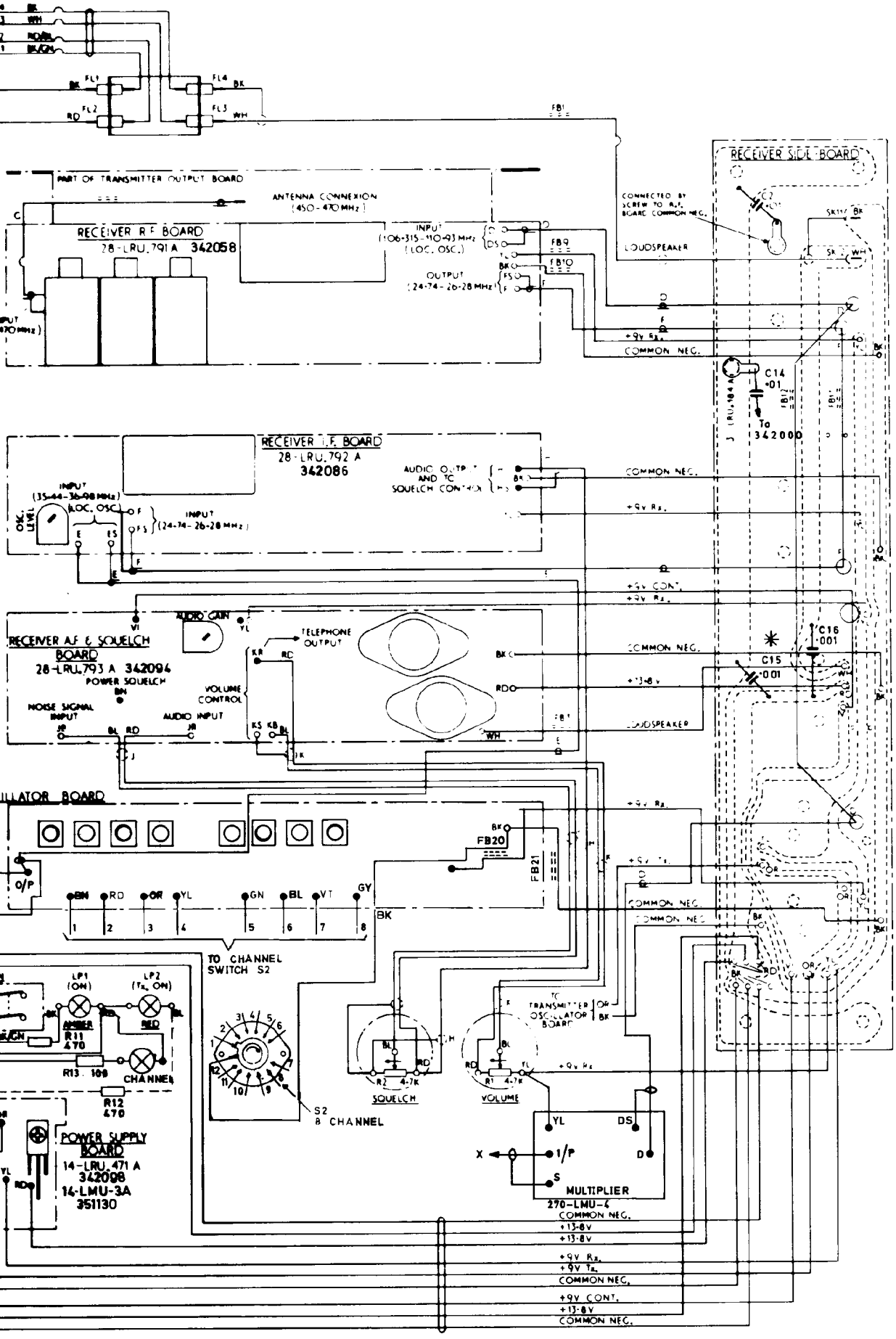
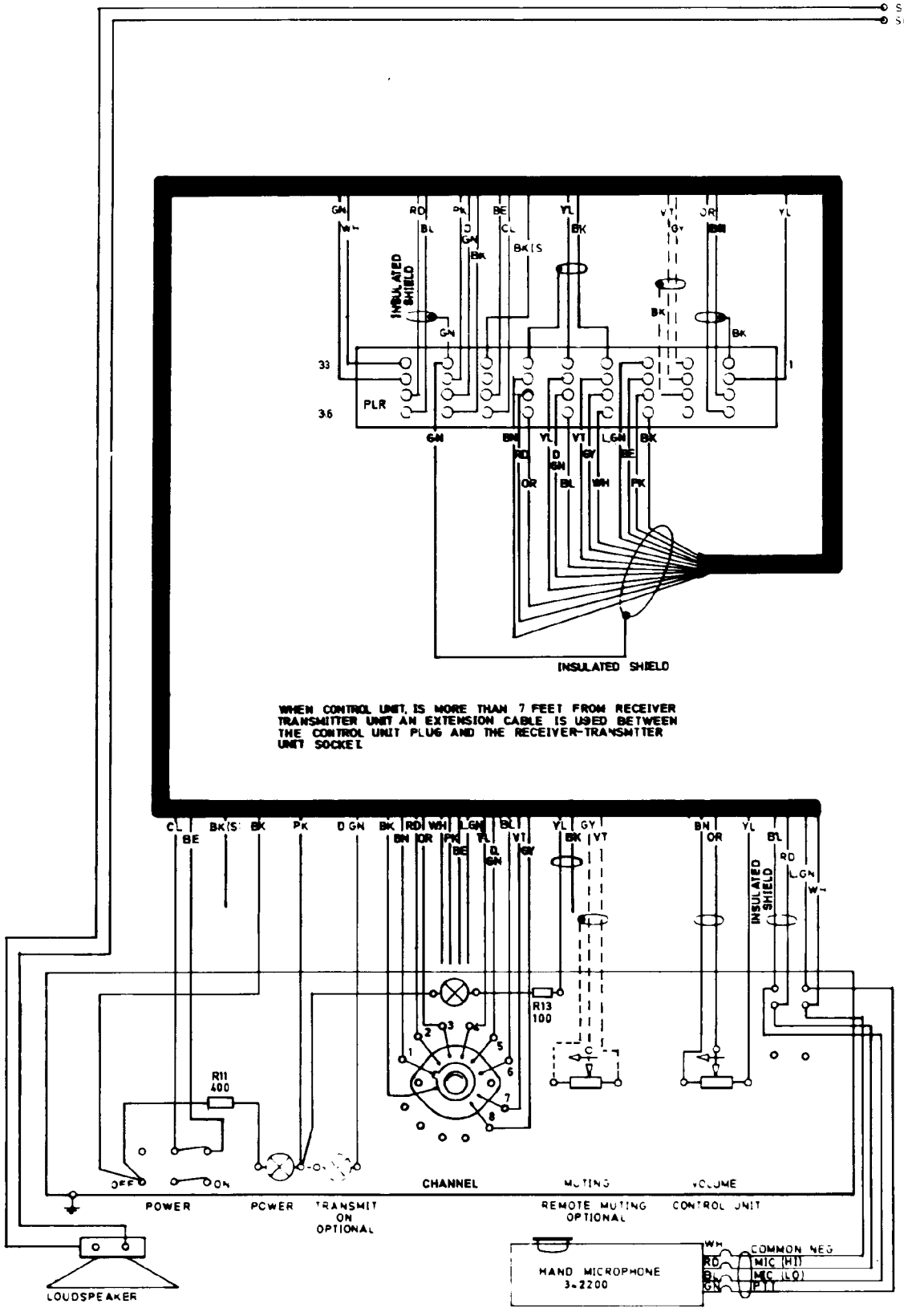


FIG. 33



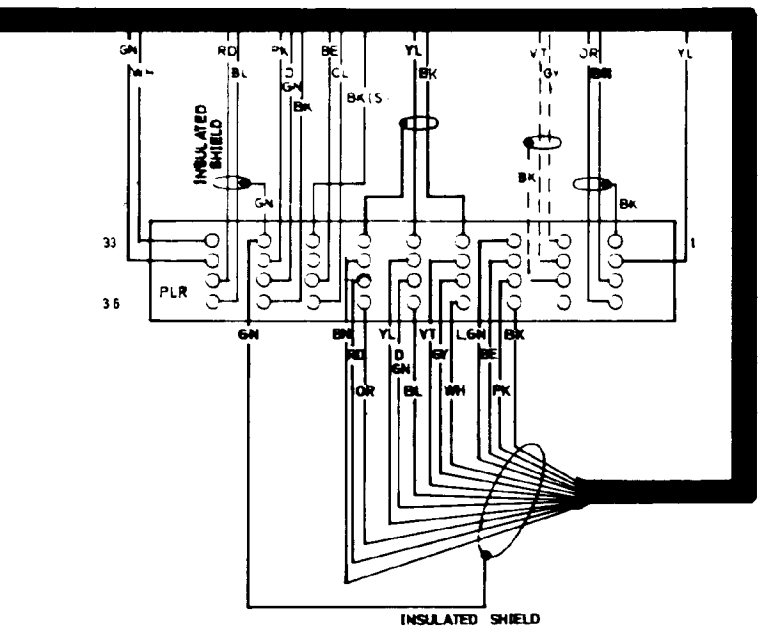
NOTE 2) SHIELDS OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE UNLESS SO SPECIFIED

IN CURRENT EQUIPMENT THE SOCKET SKR & PLUG PLR ARE A 2 ROW 25 PAIR ARRANGEMENT. PIN NUMBERING IS CONSISTANT.

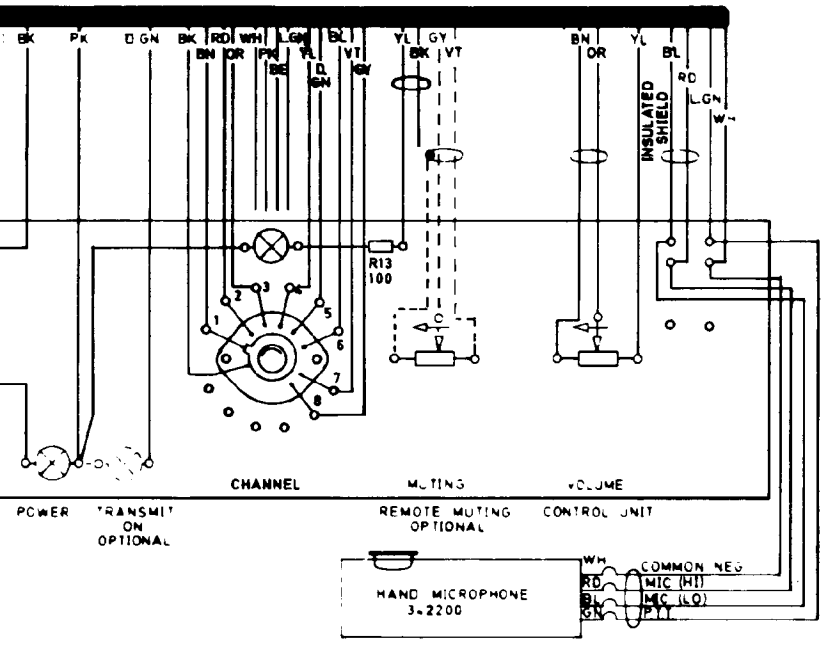
✳ C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY

WHEN 12 CHANNELS ARE USED CHANNELS 9 TO 12 INCLUSIVE ARE WIRED TO PINS 13, 11, 10 AND 9 RESPECTIVELY.

6 CH.
8 CH
12 CH



WHEN CONTROL UNIT, IS MORE THAN 7 FEET FROM RECEIVER TRANSMITTER UNIT AN EXTENSION CABLE IS USED BETWEEN THE CONTROL UNIT PLUG AND THE RECEIVER-TRANSMITTER UNIT SOCKET.



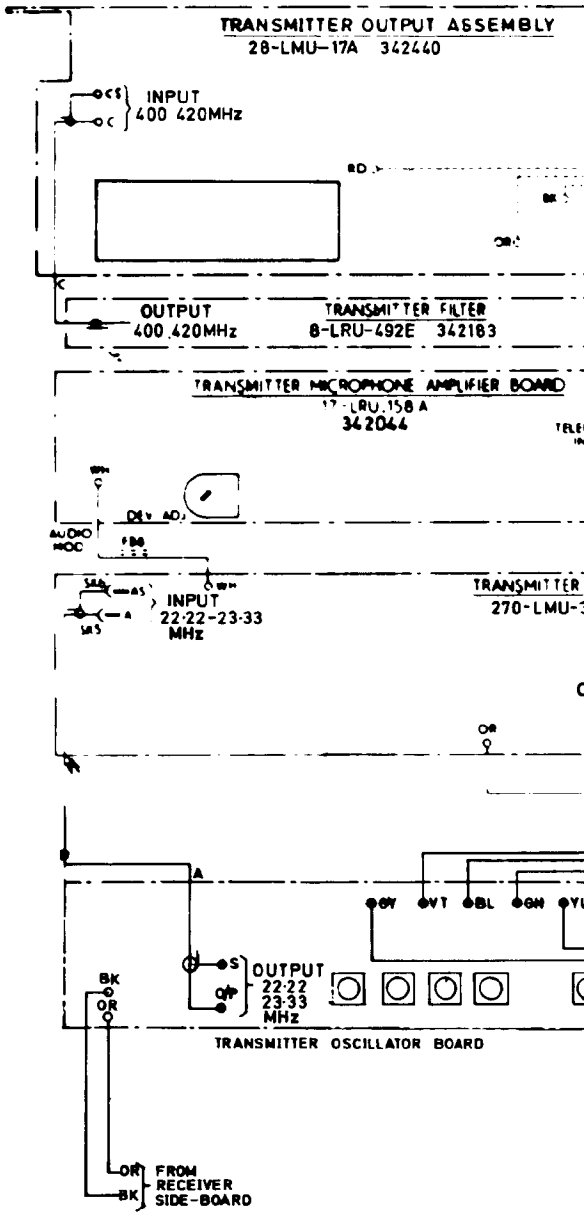
LDS OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE SS SO SPECIFIED

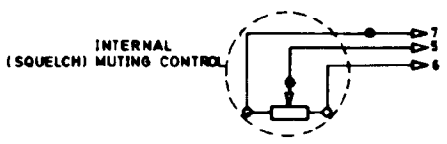
URRENT EQUIPMENT THE SOCKET SKR & PLUG PLR ARE A 25 PAIR ARRANGEMENT. PIN NUMBERING IS CONSISTANT.

USED ON EARLY PRODUCTION UNITS ONLY

12 CHANNELS ARE USED CHANNELS 9 TO 12 INCLUSIVE WIRED TO PINS 13, 11, 10 AND 9 RESPECTIVELY.

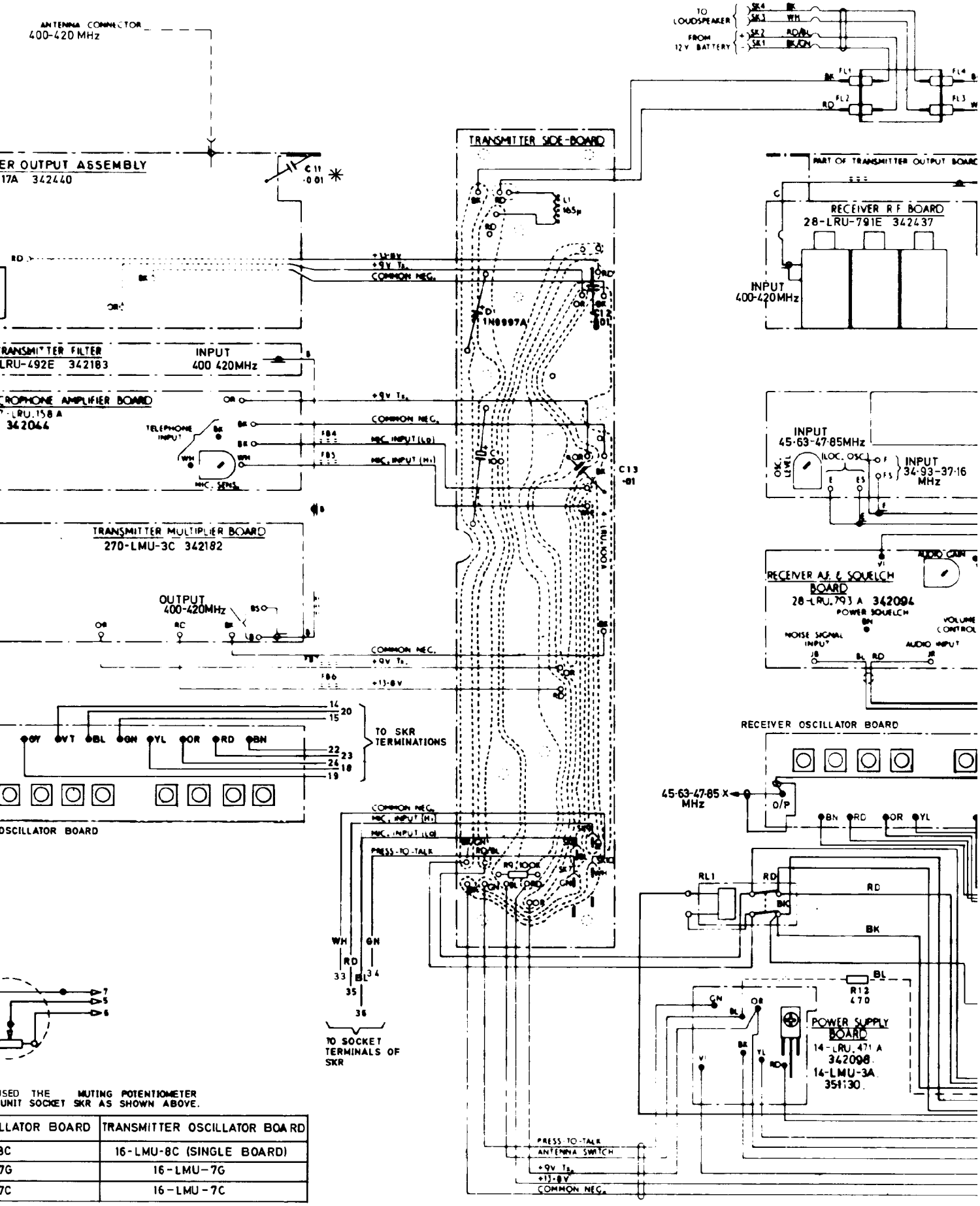
ANTENNA CONNECTOR
400-420 MHz





WHEN INTERNAL MUTING IS USED THE MUTING POTENTI IS CONNECTED TO THE UNIT SOCKET SKR AS SHOWN

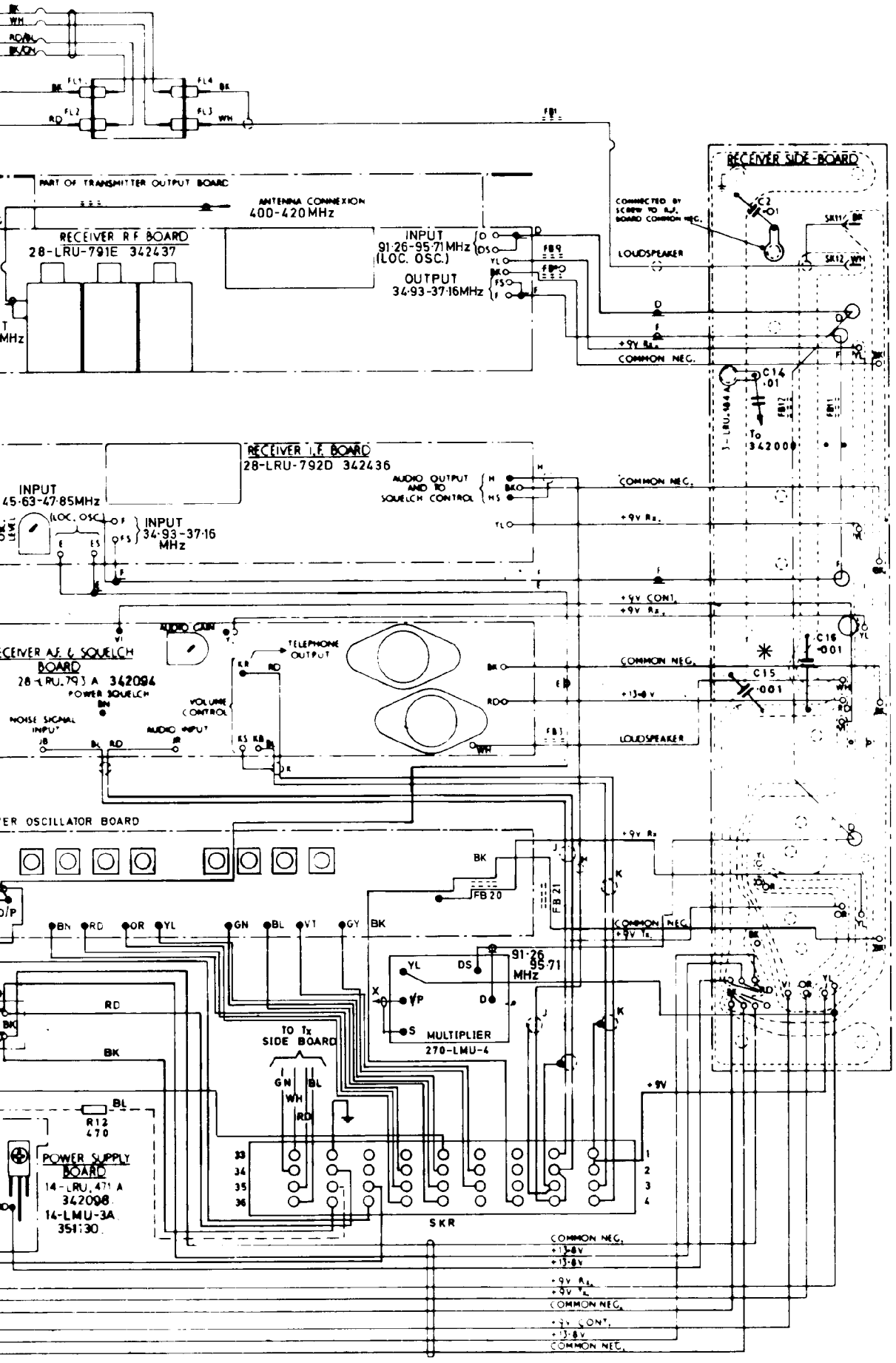
	RECEIVER OSCILLATOR BOARD	TRANSMITT
6 CHANNEL	16-LMU-8C	16-LMU-
8 CHANNEL	16-LMU-7G	16
12 CHANNEL	16-LMU-7C	16



USED THE MUTING POTENTIOMETER
UNIT SOCKET SKR AS SHOWN ABOVE.

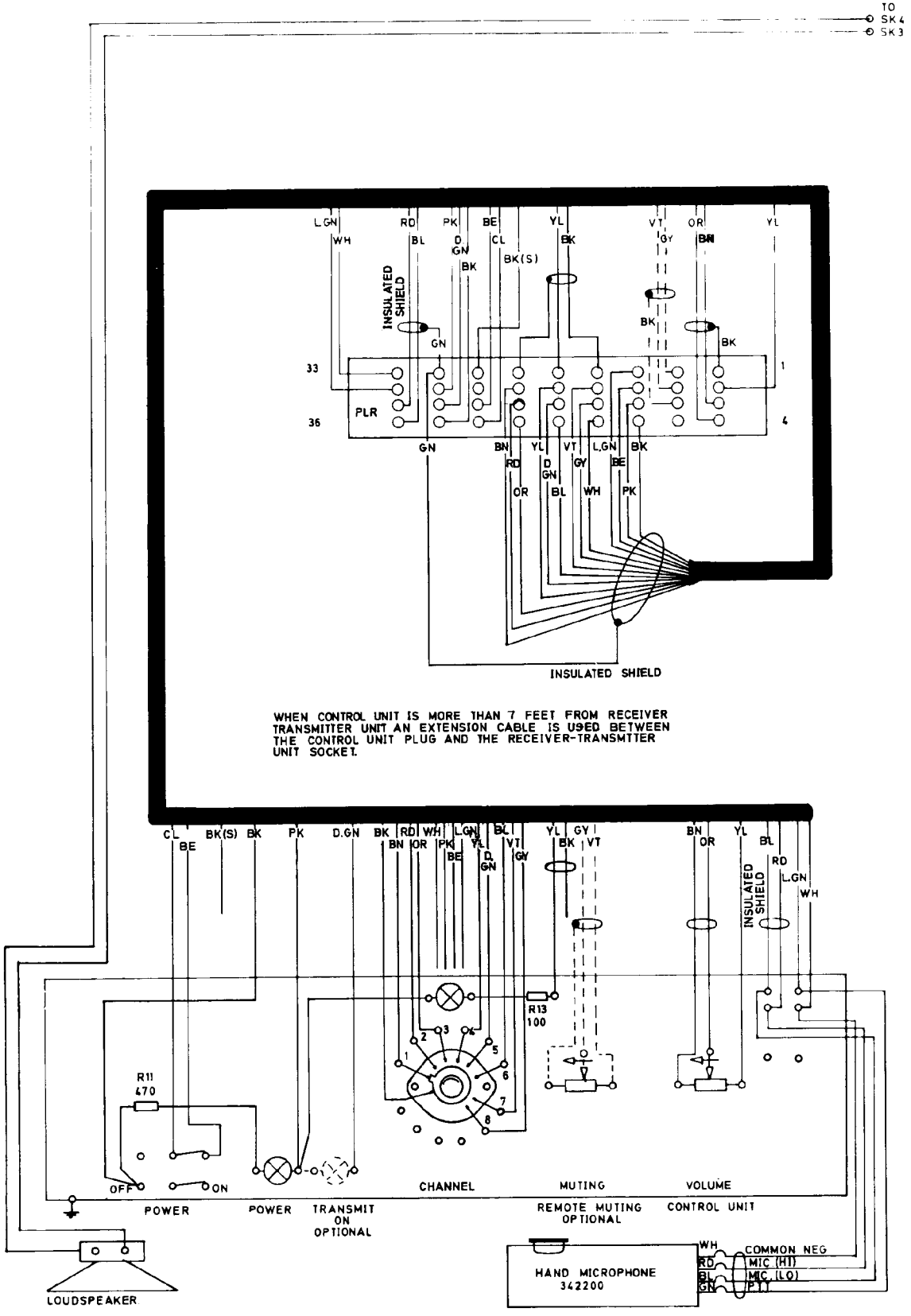
LLATOR BOARD	TRANSMITTER OSCILLATOR BOARD
8C	16-LMU-8C (SINGLE BOARD)
7G	16-LMU-7G
7C	16-LMU-7C

FIG. 34

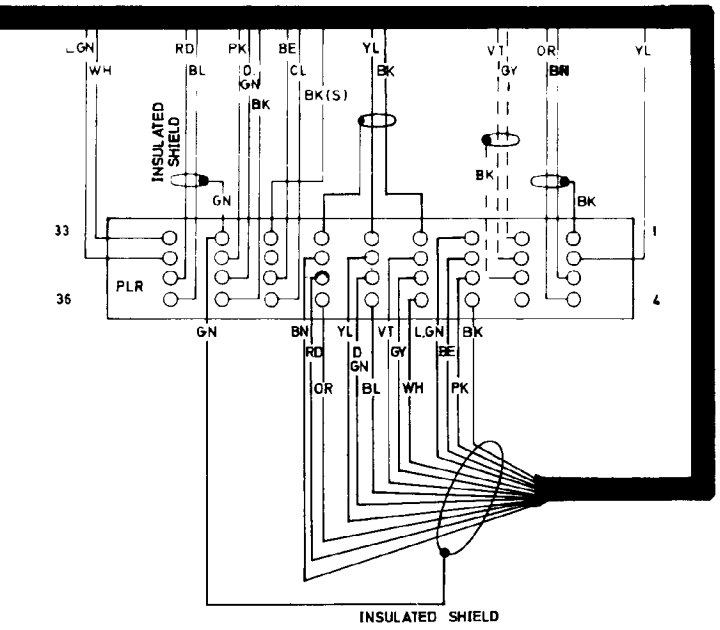


INTERCONNEXION DIAGRAM
MULTI-CHANNEL
(WITH EXTENDED CONTROL UNIT)
400-420MHz

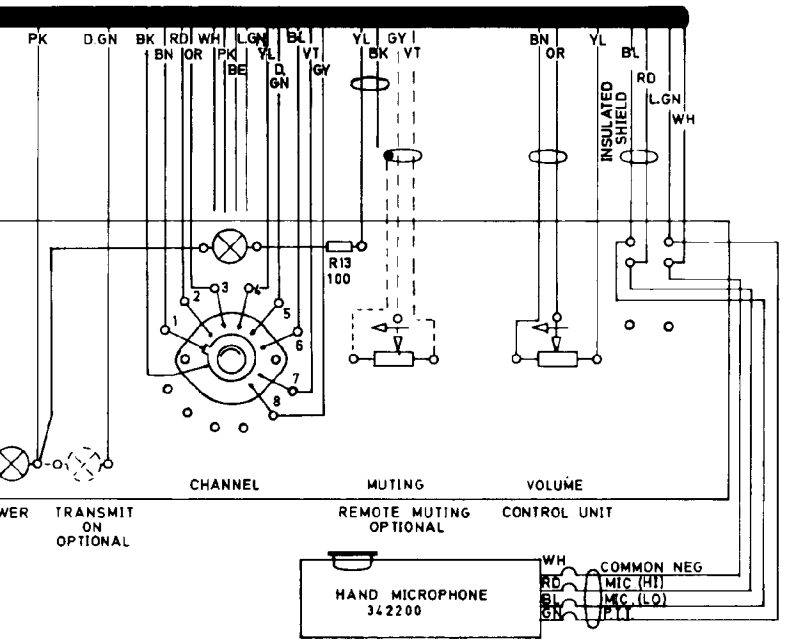
FIG. 34



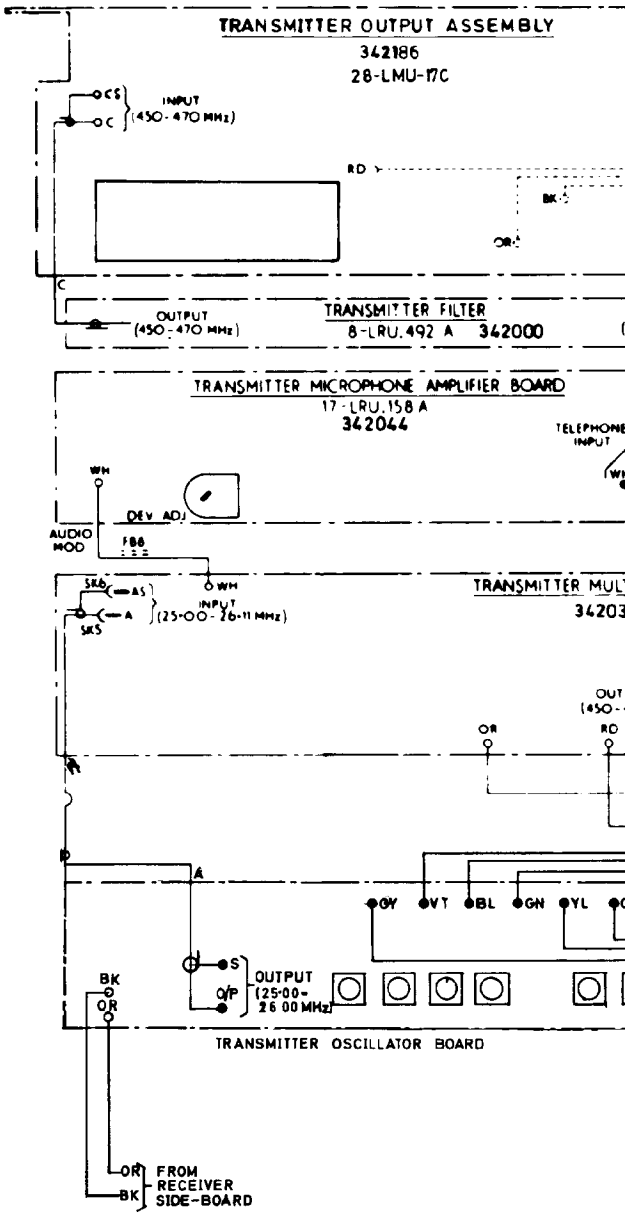
NOTE 2) SHIELDS OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE UNLESS SO SPECIFIED

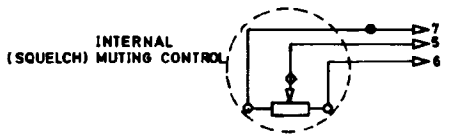


WHEN CONTROL UNIT IS MORE THAN 7 FEET FROM RECEIVER TRANSMITTER UNIT AN EXTENSION CABLE IS USED BETWEEN THE CONTROL UNIT PLUG AND THE RECEIVER-TRANSMITTER UNIT SOCKET.



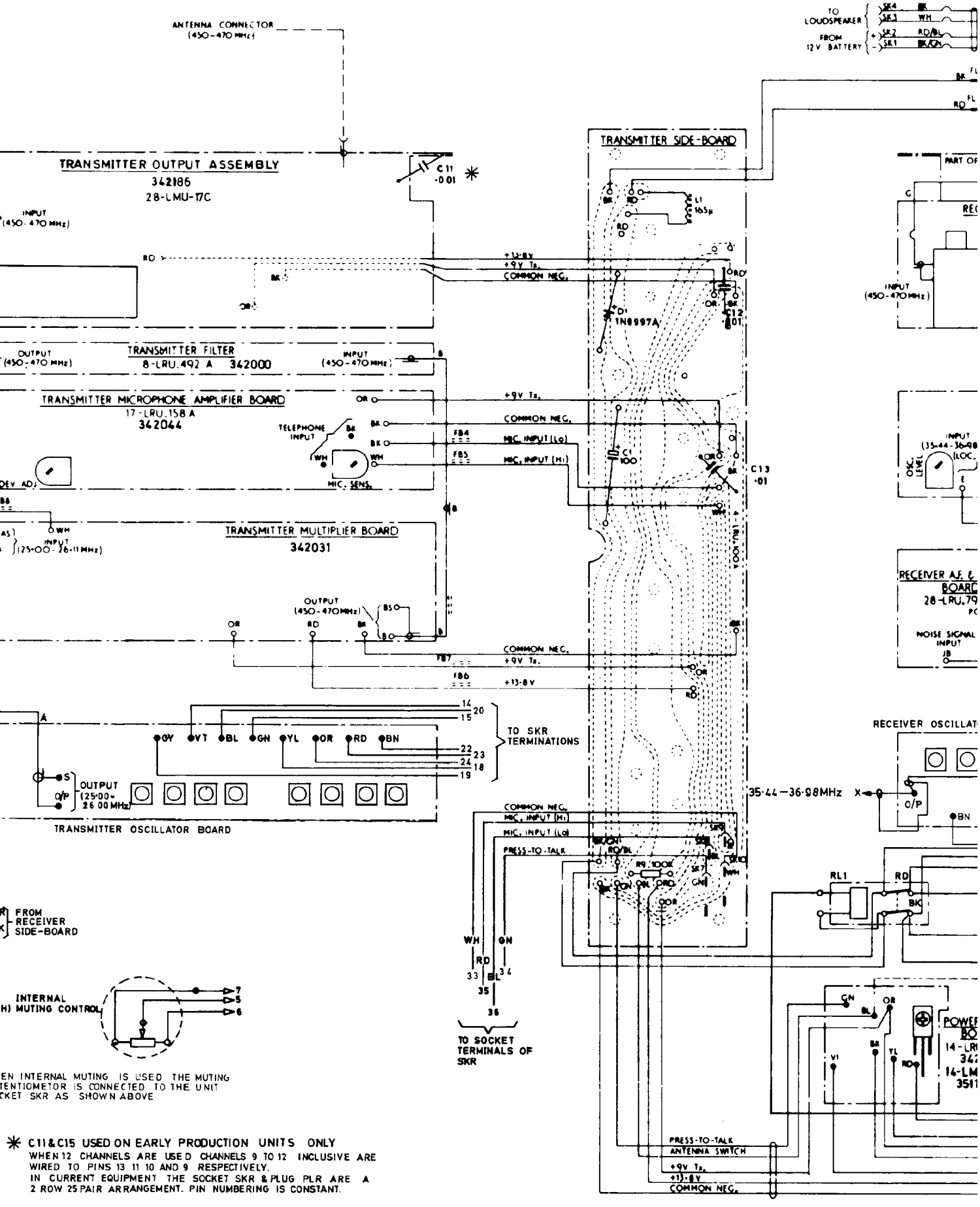
OF CABLES MUST NOT BE CONNECTED TO CONTROL UNIT CASE
D SPECIFIED





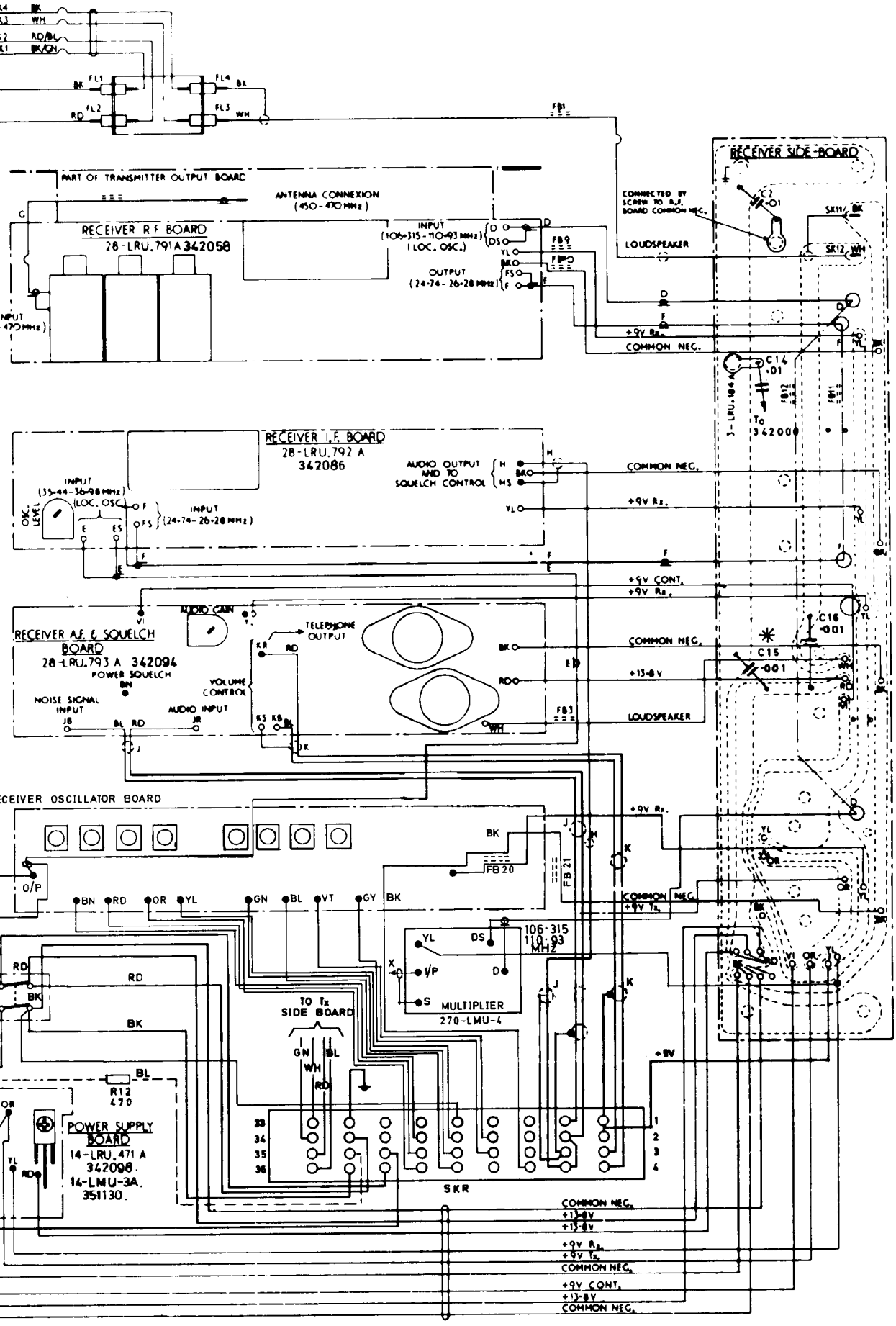
WHEN INTERNAL MUTING IS USED THE MUTING POTENTIOMETOR IS CONNECTED TO THE UNIT SOCKET SKR AS SHOWN ABOVE

✳ C11&C15 USED ON EARLY PRODUCTION UNITS ON
WHEN 12 CHANNELS ARE USED CHANNELS 9 TO 12 INCL
WIRED TO PINS 13 11 10 AND 9 RESPECTIVELY.
IN CURRENT EQUIPMENT THE SOCKET SKR & PLUG PLR
2 ROW 25 PAIR ARRANGEMENT. PIN NUMBERING IS CONST



* C11 & C15 USED ON EARLY PRODUCTION UNITS ONLY
WHEN 12 CHANNELS ARE USED CHANNELS 9 TO 12 INCLUSIVE ARE WIRED TO PINS 13 11 10 AND 9 RESPECTIVELY.
IN CURRENT EQUIPMENT THE SOCKET SKR & PLUG PLR ARE A 2 ROW 25 PAIR ARRANGEMENT. PIN NUMBERING IS CONSTANT.

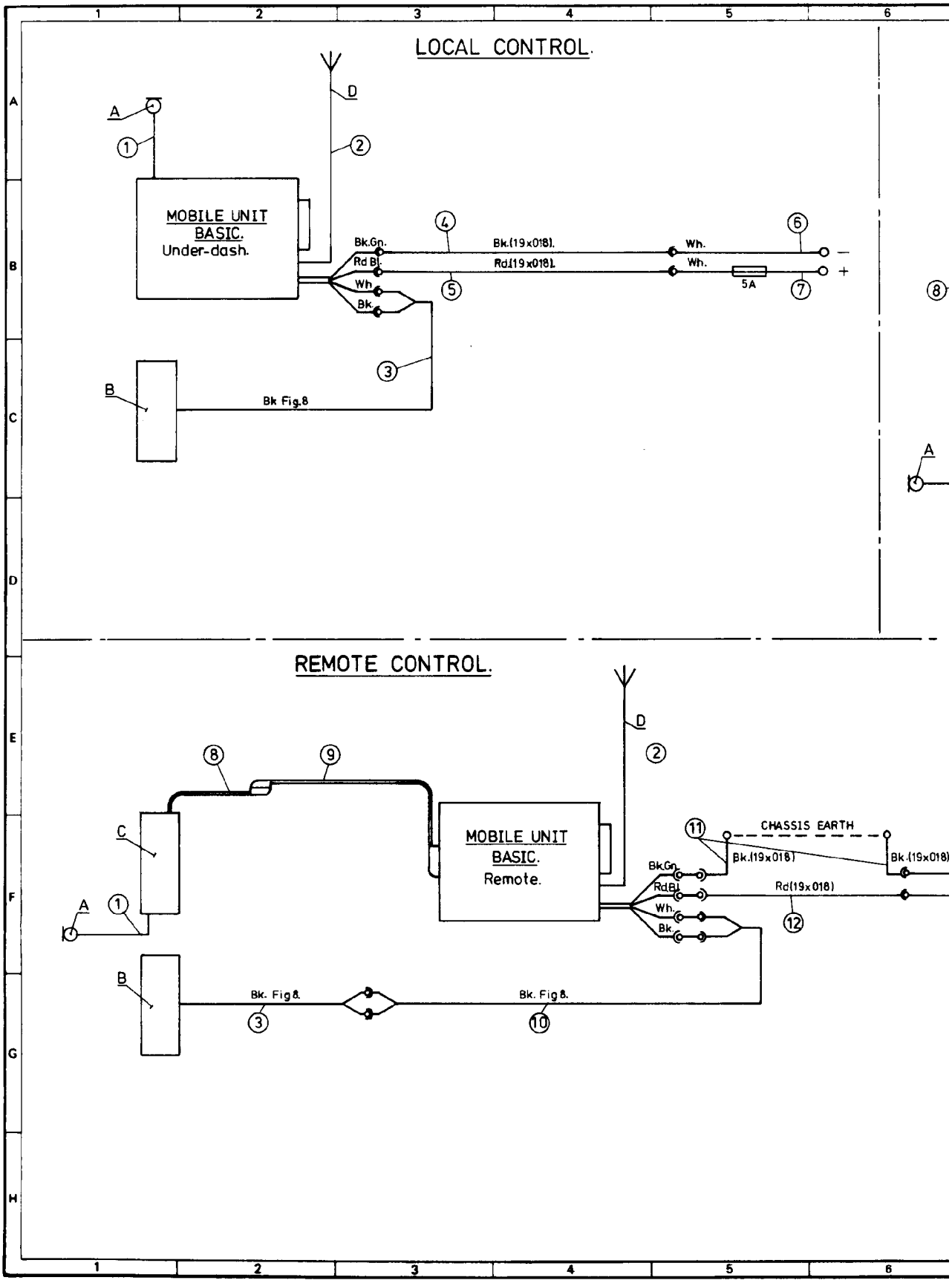
FIG. 35

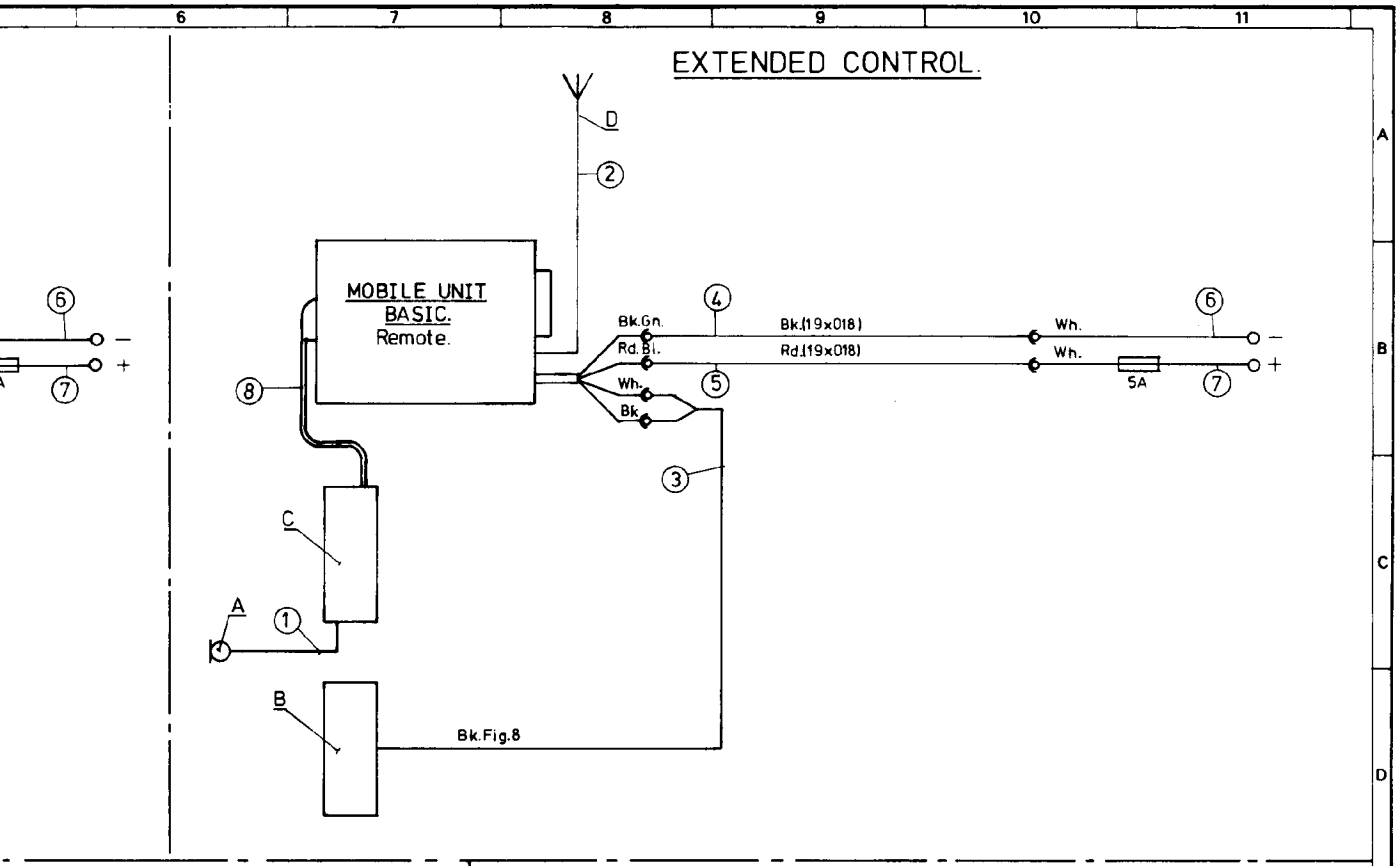


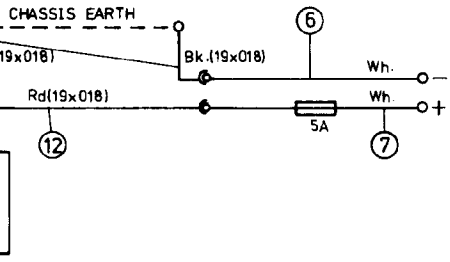
INTERCONNEXION DIAGRAM
MULTI-CHANNEL
(WITH EXTENDED CONTROL UNIT)

450-470 MHz

FIG. 35







UNITS

A MICROPHONE.
Pencil. 342200
H/Duty. 351677
Handset.

B BOX Speaker Assy.
6x2 342163
6x4 351678

C CONTROL UNIT.
VHF. 1 Ch. 351650
M/Ch. 351651
UHF. 1 Ch. 342430
M/Ch. 342431

D AERIAL
UHF 333151
VHF80 333148
VHF160 333149.

CABLES.

① CABLE Retractile 342209.
13"static. 50"ext. Part of microphone.
② CABLE Coaxial. 10ft c/w connector BNC.
Part of aerial assy.
③ LEAD Assy 8ft 342163.
Part of BOX speaker assy.'s
④ LEAD Assy Bk. 90" ┐
⑤ LEAD Assy. Rd. 90" ┘ 342542 Assy.
⑥ LEAD Assy. Wh. 12" 342543
⑦ LEAD Assy. Wh. 12" Fused. 342548
⑧ CORD Connector Ended. 84"
1 Ch. 342394
M/Ch 342380
⑨ CORD Connector Ended. 10ft.
1 Ch. 351682
M/Ch. 351684
⑩ LEAD Assy. Bk. 10ft. 342525
⑪ LEAD Assy. Bk. 20ft. 342544
⑫ LEAD Assy. Rd 20ft. 342545

DIAGRAMS ILLUSTRATE NEGATIVE EARTH INSTALATION. FOR POSITIVE EARTH REVERSE LEADS 6 & 7.

FUSE MUST BE FITTED IN ACTIVE LEAD.

NOTE LEAD Assy's 11 or 12 to be cut as required for instalation.
Refer KIT Instalation for hardware details – 351680 Local & Extended Mtg.
351681 Remote Mtg.

ISS	DATE	CHN°	
SIGNATURES			
ISS	DATE	CHN°	
SIGNATURES			

INSTALATION DIAGRAMS Typical.

STC AUSTRALIA

Fig. 36

TECH. FLASH.

VOLUME 2. ISSUE 1. DATE: 3.4.75

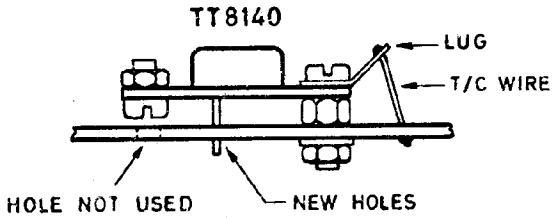
A.F. & SQUELCH BOARD 28-LMU-793A 342094

APPLICABLE EQUIPMENT MOBILE RADIO U.H.F. SERIES 191C, 191D 191E, 191F

REASON FOR CHANGE In the event of non-availability of type BD106A transistors.

NATURE OF CHANGE Use type TT8140 to replace both BD106A transistors (TR6, TR7)

PROCEDURE Refer to Diagram



Remove BD106A transistors from board. Mount TT8140 transistors from one end only using existing hole adjacent to R18 (for TR7) and R33 (for TR6) using a full nut for spacing and small solder lug as shown. The unmounted end of the transistor is held parallel to the board by a reverse mounted nut and bolt.

Drill new holes (use No.55 drill), to suit slightly offset emitter and base leads of the TT8140. Solder pins. Drill small hole in pad, adjacent to and common with the transistor mounting screw and solder short length of tinned copper wire from this point to the solder lug of each transistor.

It will be necessary also to bridge the collector of TR6 to 13.8V. Drill a small hole (No.65 drill) in the +13.8V input pad adjacent to 'RD' and another in the pad which junctions R33 and the collectors of TR4, TR6, and bridge with a length of insulated tinned copper wire.

HANDBOOK CHANGES The customer is requested to amend the handbook as follows:-

1. Change circuit schematic to read TT8140 for transistors TR6, TR7.
2. Change schedule of components for the AF & Squelch board to read TR6 TT8140 transistor silicon power DP349625
   TR7 TT8140 transistor silicon power DP349625

ISSUED BY: The Mobile Radio Division, Standard Telephones and Cables Pty. Ltd.
Moorebank Avenue, Liverpool, New South Wales, 2170, Australia.

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